ASD-TDR-63-783

THERMAL STRESS DETERMINATION TECHNIQUES IN SUPERSONIC TRANSPORT AIRCRAFT STRUCTURES

PART I. A BIBLIOGRAPHY OF THERMAL STRESS ANALYSIS REFERENCES, 1955-1962

TECHNICAL DOCUMENTARY REPORT NO. ASD-TDR-63-783, PART I

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Flight Dynamics Laboratory
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Bell Aerosystems Company, Buffalo, New York)

NOTICES

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FOREWORD

This report was prepared by Textron's Bell Aerosystems Company, Buffalo, New York, under Contract AF33(657)-8936. The work was administered under the direction of the Flight Dynamics Laboratory, Aeronautical Systems Division, by Mr. G. E. Maddux, Project Engineer. The work was performed by the Structures Section of the Aerospace Engineering Department, Bell Aerosystems Company in the period of 15 June 1962 to 31 July 1963. Mr. Richard H. Gallagher was Technical Director of the study.

The authors wish to acknowledge the assistance of Messrs. A. Krivetsky and J. Blackmon in the preparation of this report.

ABSTRACT

This report is a bibliography of thermal stress analysis literature for the period 1955-1962. References are categorized as to the language and type of publication in which they appear. Brief descriptions of the contents are given wherever applicable and feasible. Author and subject indexes are included.

Publication Review

This report has been reviewed and is approved.

W. A. SLOAN, JR.
Colonel, USAF
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I. INTRODUCTION

A. STUDY OBJECTIVES

The purpose of the study of "Thermal Stress Determination Techniques for Supersonic Transport Aircraft Structures" has been to secure information pertaining to the solution of the deformations and stresses in basic structural components subjected to thermal stimuli. This information is specifically intended for application to the design and analysis of a supersonic transport in the Mach 3 regime, but should prove to be of wider applicability.

In the development of this information the intent has been to call attention to, rather than duplicate, past efforts. Past efforts were to be the starting point of new work performed during the present study. Consequently, as a first step in this study, a bibliography of thermal stress analysis literature was prepared and the contents of the selected references were reviewed. This report constitutes an annotated form of the bibliography.

Subsequent study efforts were directed towards the development of new design data (in graphical form) for the thermal stress and instability analysis of sandwich plates and cylinders. The results of these efforts appear in Reference 1*. Still other results, in the form of computer programs for the solution of problems not amenable to parametric representation, are discussed in Reference 2.

B. APPROACH TO THE PRESENT REPORT

Thermal stress problems have been of deep concern to airframe designers for over ten years and in the intervening period many comprehensive treatises on the subject have been published. Those which are noteworthy are discussed at the close of this chapter. Of particular interest is WADC Technical Report 56-102. "Thermal Stress Analysis of Aircraft-Part II, Bibliography" by B.A. Boley, J.H. Weiner, and I.S. Tolins. This report traces the topic from its origins in the year 1805 up through mid-1955. Thus, to avoid duplication of past efforts, the present bibliography uses WADC TR 56-102, Part II as a starting point and advances the bibliography from 1955 through to the beginning of 1963.

In this bibliography, attention has been restricted to thermal stress analysis and to test conditions which involve thermal stress. In general, references dealing

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*References cited in this chapter appear at the close of the chapter.

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with related matters in aerodynamically heated airframes (e.g., thermal effects on material properties) are not cited. Even with this limitation the bibliography assumes large proportions, due to the recent intense interest in thermal stress. Approximately 600 references are listed. In contrast, WADC TR 56-102, Part II, contains less than 250 references for the entire period prior to 1955.

Wherever feasible and appropriate, the listing of a reference is accompanied by a brief summary of its contents. These summaries have generally been derived from abstracts of the associated reference.

Normally, a bibliography is arranged in either chronological order or in an alphabetical order of the authors. In preparing the present bibliography, however, it was felt that the interests of the practicing analyst would best be served by first segregating the references with respect to the language in which they are published and then with respect to type of publication.

The principal distinction with respect to language is made between English and all other languages. Articles appearing in journals whose basic language is English are cited in Chapter II. References appearing in publications which are fundamentally devoted to papers in a language other than English are presented in Chapter III. In accordance with this division of references, any English language article appearing in what is basically a foreign language publication is assigned to Chapter III. Where it is known that any such reference is written in English a notation to that effect is included.

In Chapter II the references are grouped under four major headings.

A. Periodical literature
B. Reports
C. Special publications
D. Books

The various journals contributing to heading A and the agencies whose reports are cited under heading B in many cases represent respective specific interests. Under headings A and B, therefore, the references are grouped (chronologically) with respect to the journals in which they appear or the agencies under whose sponsorship they were published. Hence, the analyst who is concerned with a particular type or problem can immediately examine the publications whose interests are most closely allied with the problem. (Only journals and agencies that have produced a significant number of thermal stress analysis references in the subject period are given separate classifications; other references are grouped under a "Miscellaneous" heading). References appearing under headings C and D are simply given in chronological order.

A somewhat different approach was taken in organizing Chapter III, the Foreign Language References. The major subdivisions are predominantly those dictated by language, rather than the publication, and are as follows:

A. German references
B. Polish references
C. Russian references
D. Other languages and countries
E. Books

It should be noted that a number of countries are represented under the heading of German Language (Austria, East and West Germany). Since Germany, Poland and Russia publish journals which have featured many thermal stress analysis references, these journals are given separate treatment in subdivisions III, A, III.B., and III.C. Headings III.D and III.E simply list the references in chronological order.

To facilitate indexing, each reference is assigned a designation that pinpoints its location in the bibliography. In the system employed, Reference II.B.2.5, refers to:

II.	an English language reference (Chapter II),
B.	published by an agency (Section B)
2.	which is, specifically, AGARD (heading 2);
5.	the reference is the fifth listed in Section III.B.2.

Two indexes have been prepared. The first, Chapter IV, is an author index. The second index, Chapter V, is a subject index.

C. SPECIAL REFERENCES

A number of comprehensive treatises on thermal stress and allied problems have been published during the time period covered by this report. Although these are cited under the appropriate headings in various sections of Chapters II and III. it is believed that they merit special note. These references are:

1. Manson, S.S. "Thermal Stresses in Design", Machine Design. A 22-part series, extending from June 1958 through August 1959. See items II.A.9.18, II.A.9.23 and II.A.9.29 of this report.

2. Brahtz, J.F., and Dean, A. "An Account of Research Information Pertaining to Aerodynamic Heating of Airframe" WADC TR 55-99, 1955. See item II.B.9.4.

3. Dukes, W.H. and Schnitt, A. "Structural Design for Aerodynamic Heating - Parts I and II" WADC TR 55-305, 1956. See item II.B.9.8.

4. Switzky, H., Newman, M., and Forray, M. "Thermo-Structural Analysis Manual" ASD TR 60-517, Sept. 1960. See item II.B.9.51.

5. Gatewood, B.C., "Thermal Stresses" McGraw-Hill Book Co. 1957. See item II.D.1.

6. Hoff, N.J. (Editor) "High Temperature Effects in Aircraft Structures" AGARDograph 28, Pergamon Press, 1958. See item II.D.2.

7. Boley, B.A. and Weiner, J.H. "Theory of Thermal Stresses" John Wiley, N.Y., 1960. See item II.D.3.

8. Parkus, H. "Transient Thermal Stresses" (Instationare Warmespannungen) (in German) Springer-Verlag, Vienna, 1959. See item III.D.2.

D. REFERENCES

1. Gellatly, R.A. and Gallagher, R.H. "Thermal Stress Determination Techniques for Supersonic Transport Aircraft Structures. Part II - Design Data for Sandwich Plates and Cylinders Under Applied Loads and Thermal Gradients" ASD-TDR-63-783, Part II, January 1964

2. Gallagher, R.H., Padlog, J. and Huff, R.D. "Thermal Stress Determination Techniques for Supersonic Transport Aircraft Structures Part III - Computer Programs for Beam, Plate, and Cylindrical Shell Analysis" ASD-TDR-63-783, Part III, January 1964

II. ENGLISH LANGUAGE REFERENCES

A. PERIODICAL LITERATURE

1. Aeronautical Engineering Review and Aero/Space Engineering ("Aeronautical Engineering Review" Prior to May, 1958).

1956 - Feb.

1.1 Hoff, N. J.: "Experiment and Theory in the Investigation of the Behavior of Structures at High Temperatures" p. 39.

1956 - Oct.

1.2 Levy, S.: "Thermal Stresses and Deformations in Beams" p. 62.

1956 - Nov.

1.3 Abraham, H.: "Techniques and Problems in Testing Structures at Elevated Temperatures" p. 56-60.

1.4 Dow, N.F.: "A Re-Evaluation of Some Air-Frame Thermal Problems", p. 61-66. A discussion of the significance of the problems of material selection, thermal stresses, and inelasticity or creep encountered in the airframe in supersonic flight.

1957 - Apr.

1.5 Sanders, W. B., Jr., and Trabant, E. A.: "An Analytical Method of Evaluating Thermal Stresses in Gas-Turbine Blades" p. 52-54. Analytical method for approximately computing film coefficient of heat transfer and thermal stresses in gas-turbine blades.

1957 - Sept.

1.6 Meyer, H.: "Thermoelastic Distortion and Wing Structural Design" p. 46-53. Review of laboratory and flight-test programs involving structures at elevated temperatures. Various methods of detailed structural design are examined to show their limitations and possibilities.

1958 - Oct.

1.7 Rogers, M.: "Aerothermoelasticity" p. 34-43, 64. Presentation and evaluation of some effects of aerodynamic heating on aeroelastic phenomena, and discussion of the possible impact of this consideration on contemplated design practices.

II.A.1. Aero/Space Engineering (Cont'd)

1961 - Aug.

1.8 Yao, J. C.: "Thermal Stress Analysis of Sandwich-Type Cylindrical Shells by the Cross Method" p. 24-25, 88-93. Application of the Cross moment-distribution method to the solution of the time-independent axisymmetric thermal stresses in a long sandwich-type cylindrical shell.

2. Aeronautical Quarterly

1956 - Aug.

2.1 Hemp, W. S.: "Fundamental Principles and Theorems of Thermoelasticity" p. 184-192. Outlines the foundations of the subject and derives generalizations of the usual variational theorems used most often in structural analysis.

1959 - Feb.

2.2 Przemieniecki, J. S.: "Thermal Stresses in Rectangular Plates" p. 65-78. Application of the characteristic functions for beam vibration modes to derive an approximate solution for the calculation of thermal stresses in rectangular isotropic flat plates subjected to arbitrary temperature distributions in the plane of the plate and constant temperature through the plate thickness.

1960 - Aug.

2.3 Przemieniecki, J. S.: "Design Charts for Transient Temperature and Thermal Stress Distributions in Thermally Thick Plates" p. 269-284. A semi-numerical method for determining temperatures and thermal stresses in plates with an arbitrary variation of the heat transfer coefficient and the adiabatic wall temperature of the boundary layer. The method is also applied to thermally thin plates subjected to arbitrary heating conditions.

3. Aircraft Engineering

1954 - Feb.

3.1 Anon: "A Conference on Thermal Stress" p. 51-54. Summaries of Papers Read at the Meetings Held by the Stress Analysis Group of the Institute of Physics at Wills Hall, University of Bristol, on January 7 and 8, 1954.

1954 - April

3.2 Loveless, E.: "The Problem of Thermal Stress in Aircraft Structures" p. 122-124.

3.3 Hemp, W. S.: "Fundamental Principles and Methods of Thermoelasticity" p. 126-127.

II.A.3. Aircraft Engineering (Cont'd)

1954 - May

3.4 Horton, W.H.: "Laboratory Simulation of Kinetic Heating" p. 138-144.

1954 - July

3.5 Rendel, D.: "Thermal Problems of High Performance Flight" p. 220-223.

3.6 1954 - Sept.

Sobey, A.J.: "Thermoelastic Similarity" p. 298-299.

1954 - Dec.

3.7 Parkes, E.W.: "Wings Under Repeated Thermal Stress" p. 402-406. Repeated thermal loading sets up four types of stress-strain systems. Permanent elasticity and shakedown to an elastic state, which are safe, and ultimate plasticity and incremental collapse, which are unsafe. These stress-strain conditions are investigated and conditions for their occurrence determined.

1956 - June

3.8 Parkes, E.W.: "Panels Under Thermal Stress" p. 180-186. Consideration is given to a panel loaded predominately in one direction and restrained from free thermal expansion in the transverse direction by attachment to heavy members which exhibit slow response to external temperature change. Part one of the paper concerns a general analysis of the post buckling behavior of a simply-supported square panel. Part two includes particular solutions for panels constrained in one direction and heated, panels loaded in two directions and panels constrained in one direction, loaded in the other direction and heated. Numerical examples are included.

1956 - Nov.

3.9 Hemp, W.S.: "Thermoelastic Formulae for the Analysis of Beams" p. 374-376. Equations for thermal stress analysis, representing a generalization of the engineering theory of bending and of the Wagner-Kappus torsion theory to include the effects of nonuniform temperature distribution.

1956 - Nov.

3.10 Parkes, E.W.: "Incremental Collapse Due to Thermal Stress" p. 395-396. Expressions for the incremental deformations of an aircraft wing accompanying each cycle of kinetic heating. Analysis takes into account the variation of material properties with temperature and the short duration of flights at high speeds.

II.A.3. Aircraft Engineering (Cont'd)

1957 - Mar.

3.11 Parkes, E. W.: "Stresses in a Plate Due to a Local Hot Spot" p. 67-69. Analysis in terms of two parameters--one defining the size of the hot spot in relation to the size of the plate, the other defining the flexibility of the heated area compared with that of the plate.

1957 - May

3.12 Norbury, J.: "Thermal Stresses in Disks of Constant Thickness" p. 132-137. Investigation to determine the effect of temperature profile on stresses for a given temperature difference between the inner radius and the periphery of a disc of constant thickness. A power-law temperature distribution is assumed and the exponent is varied.

1957 - Oct.

3.13 Kochanski, S. and Argyris, J.: "Some Effects of Kinetic Heating on the Stiffness of Thin Wings - I" p. 310-318. Analysis (based on the small deflection theory) showing that the thermal stresses developed in accelerated flight lead also to a loss of flexural stiffness of equally serious magnitude. Included is an account of the loss of torsional stiffness, as well as a re-examination of the problem from the point of view of the large deflection theory.

1958 - Feb.

3.14 Kochanski, S. and Argyris, J.: "Some Effects of Kinetic Heating on the Stiffness of Thin Wings - II" p. 32-40. Investigation of the effects of large spanwise curvature and rate of twist on the distortion of the cross section when thermal stresses are present. The moment-curvature and the torque-rate of nonlinear twist relationships are established, and it is shown that large deformations give rise to a pronounced coupling between twisting and bending modes.

1958 - April

3.15 Kochanski, S. and Argyris, J.: "Some Effects of Kinetic Heating on the Stiffness of Thin Wings II-Appendix" p. 114-117. Exact analysis for large spanwise deformations in parabolic wings subject to parabolic temperature gradients and large spanwise curvature and twist.

1959 - May

3.16 Johns, D. J.: "Discontinuity Stresses in Stiffened Cylindrical Shells--The Determination of Stresses Due to Pressure and Thermal Effects in Certain Classes of Stiffened Cylindrical Shells" p. 131-132. Approach to the calculation of discontinuity stresses for pressurized and heated uniform cylindrical shells stiffened by plane bulkheads. The shells are assumed to be at uniform temperatures and maintained at different internal

II.A.3. Aircraft Engineering (Cont'd)

3.16 pressures. The bulkhead is subjected to an arbitrary radial temperature distribution with linear variation of temperature between the faces of the bulkhead.

1960 - Aug.

3.17 Parkes, E.W.: "Effects of Repeated Thermal Loading--The Influence of the Variation of Strength with Temperature on Structural Behaviour" p. 222-229. A simple redundant structure is subjected to temperature cyclings to determine the influence of the yield stress/temperature relation on its behavior. The range and periodic time of the temperature cycle are included as subsidiary variables.

1961 - Oct.

3.18 Carey, E.P.: "Transient Temperature Distributions in an Insulated Multi-Spar Wing" p. 282-288. Approximate method for the determination of the transient temperature distributions and thermal stresses in an idealized, insulated, multi-spar wing subjected to aerodynamic heating. Based upon the division of the structure into a number of regions which are sufficiently small to permit reduction of the partial differential equation for heat flow to an ordinary differential equation for each region.

1962 - November

3.19 Ayers, K.B.: "Thermal Stresses in I-Section Beams", pp. 320-324. Calculation of thermal stresses due to arbitrary temperature distributions for beams of I-Section or of multicell sections which can be considered to be built up from I-Section units. Stress distributions are presented graphically for a wide range of the parameters involved. It is shown that for a high-speed aircraft the thermal stresses alone could produce plasticity in a homogeneous structure.

4. Journal of the Aero/Space Sciences ("Journal of the Aeronautical Sciences" prior to July 1958)

1954 - July

4.1 Schuh, H.: "On the Calculation of Thermal Stresses in Parts of Aircraft Structures at Supersonic Speeds" p. 575. Finite differences and a step-by-step procedure applied to problems where both boundary layer temperature and heat transfer coefficient are arbitrary functions of time. Comparison of analytical and numerical solutions is included.

1954 - Sept.

4.2 Gatewood, B.E.: "Thermal Loads on Joints" p. 645-646. Investigates the loads on rivets or bolts when two bars of different materials are bolted or riveted together and subjected to a temperature change, or two bars of the same material are subjected to different temperature changes.

II.A.4. Journal of the Aero/Space Sciences ("Journal of the Aeronautical Sciences" prior to July 1958) (Cont'd)

1954 - Oct.

4.3 Levy, S.: "Determination of Loads in the Presence of Thermal Stresses" p. 659-664. Shows how, in the presence of thermal strains, the total axial load, bending moment, and shear force in a member may be deduced by combining the outputs of several suitably located temperature-compensated gages.

1955 - May

4.5 Przemieniecki, J.S.: "Transient Temperatures and Stresses in Plates Attained in High-Speed Flight" p. 345-348. Presents a simplified method for calculating transient temperatures and stresses in plates subjected to sudden aerodynamic heating. Solution of the differential equations of heat flow is obtained by Laplace transformation assuming zero heat transfer on the inside plate surface. The heat transfer coefficient on the outside surface is determined from aerodynamic conditions in the free stream just outside the boundary layer.

1955 - July

4.6 "Analysis of Thermal Stresses in Conical Shells" p. 506.

1955 - Dec.

4.7 Schuh, H., "Transient Temperature Distributions and Thermal Stresses in a Skin-Shear Web Configuration at High-Speed Flight for a Wide Range of Parameters" p. 12, 829-836. Transient temperature distributions and thermal stresses are calculated for a typical wing I-section composed of a cover plate and shear web. Parametric results are presented in graphical form.

4.8 Schneider, P.J., "Variation of Maximum Thermal Stress in Free Plates" p. 872-873. A resume is presented for stresses in thin, free plates under six types of heating.

1956 - Jan.

4.9 Boley, B. A., "The Determination of Temperature, Stresses, and Deflections in Two-Dimensional Thermoelastic Problems" p. 67-75. Analytical successive approximation method to solve linear partial differential equations applied to bars and plates and to establish a theoretical basis for a thermoelastic strength of materials.

II.A.4. Journal of the Aero/Space Sciences ("Journal of the Aeronautical Sciences" prior to July 1958) (Cont'd)

1956 - Feb.

4.10 Boley, B.A., "Thermally Induced Vibrations of Beams" p. 179-181. Deflection analysis of a simply supported rectangular beam with the top side subjected to a step function heat application. Twc solutions are presented. The "static" solution neglects the effect of inertia load. The "dynamic" solution considers this effect. Comparison of the two solutions is effected.

1956 - June

4.11 Hoff, N. J., "Approximate Analysis of the Reduction in Torsional Rigidity and of the Torsional Buckling of Solid Wings Under Thermal Stresses" p. 603-604. Solution by energy method of a thin doubly symmetric uniform section with temperature constant spanwise and thicknesswise, but varying symmetrically chordwise.

1956 - Nov.

4.12 Goldberg, M. A., "Investigation of the Temperature Distribution and Thermal Stresses in a Hypersonic Wing Structure" p. 981-990.

4.13 Hoff, N. J., "Thermal Buckling of Supersonic Wing Panels" p. 1019-1028. An analysis of the temperature and thermal stress distributions in multicellular wing structures. A method of instability analysis for the panels of cover plates subject to thermal stresses is established.

1956 - Dec.

4.14 Budiansky, B., and Mayers, J., "Influence of Aerodynamic Heating on the Effective Torsional Stiffness of Thin Wings" p. 1081-1108. Theoretical results for solid wings of symmetrical double-wedge cross section accelerated to supersonic speeds, taking into account the effects of such parameters as Mach Number, instantaneous and finite acceleration, and thickness ratio.

4.15 Harris, L. A., "Axial Compression Buckling of a Pressurized Cylinder with a Thermally Induced Ring Compression" p. 1120. A report of an experimental investigation wherein a heated cylinder was subjected to internal pressure and a uniform axial compressive load while restrained at midheight by a refrigerated ring. Results indicate that the axial compressive buckling load of the cylinder was not appreciably lowered.

1957 - Feb.

4.16 Boley, B. A., "The Calculation of Thermoelastic Beam Deflection by the Principle of Virtual Work" p. 139-141. Study of an appropriate approximate formula to assess its accuracy from the standpoint of a more rigorous thermoelastic solution.

II.A.4. Journal of the Aero/Space Sciences ("Journal of the Aeronautical Sciences" prior to July 1958) (Cont'd)

4.17 Gatewood, B. E., "Effect of Thermal Resistance of Joints Upon Thermal Stresses" p. 152-153.

1957 - March

4.18 Barber, A., Weiner, J., and Boley, B., "An Analysis of the Effect of Thermal Contact Resistance in a Sheet-Stringer Structure" p. 232-234. Analysis of the effect of thermal-contact resistance in a typical sheet-stringer structure under transient heating conditions.

4.19 Galletly, G. D., "On Axisymmetric Thermal Stresses in Thin Shells of Revolution" p. 201-202.

1957 - April

4.20 Singer, J., and Hoff, N. J., "Effect of the Change in Thermal Stresses Due to Large Deflections on the Torsional Rigidity of Wings" p. 310-311.

1957 - May

4.21 Zuk, W., "Thermal Buckling of Clamped Cylindrical Shells" p. 389. Presents an analysis for critical buckling temperature based on Galerkin's method in conjunction with Donnell's equation. The shell is assumed unrestrained longitudinally and fully restrained laterally at the edges.

1957 - June

4.22 Biot, M., "Influence of Thermal Stresses on the Aeroelastic Stability of Supersonic Wings" p. 418-420, 429. Evaluation of the effect of thermal stress on the chordwise bending, the antielastic effects, and the nonlinear aspects due to finite deformation.

1957 - Aug.

4.23 Isakson, G., "A Simple Model Study of Transient Temperature and Thermal Stress Distribution Due to Aerodynamic Heating" p. 611-619.. Investigations of two cases: a) that of convective heat transfer into one side of a flat plate, representing a thick skin, and the effect of the resulting temperature distribution in inducing thermal stresses associated with bending restraint at the plate edges; b) that of the wide-flanged I-beam with convective heat transfer into the outer faces of the flanges.

1957 -

4.24 Chen, S. Y., "Comments on Investigation of the Temperature Distribution and Thermal Stresses in a Hypersonic Wing Structure" p. 544. Discussion of II.A.4.12 indicating certain mathematical irregularities.

1957 -

4.25 Singer, J., "Effects of Amplitude on the Torsional Vibrations of Solid Wings Subjected to Aerodynamic Heating" p. 620.

II.A.4. Journal of the Aero/Space Sciences ("Journal of the Aeronautical Sciences" prior to July 1958) (Cont'd)

1958 - Jan.

4.26 Forray, M., and Zaid, M., "Thermal Stresses in a Circular Bulkhead Subjected to a Radial Temperature Distribution" p. 63-64. Analysis of thermal stresses in a circular bulkhead consisting of a web and cap assembly. The case of parabolic temperature distribution which includes linearly varying and uniform temperatures is considered in detail.

1958 - March

4.27 Klosner, J., and Forray, M., "Buckling of Simply Supported Rectangular Plates Under Arbitrary Symmetrical Temperature Distributions" p. 181-184. Plane-stress solution for a plate subjected to an arbitrary symmetric temperature distribution, assuming straight plate edges. The deflection function for the buckled plate is approximated by the first four terms of a double infinite harmonic series, and the Rayleigh-Ritz procedure is used to determine approximately when initial buckling occurs.

4.28 Galletly, G. D., "On Axisymmetric Thermal Stresses in Thin Shells of Revolution", p. 201 (Also, Aug., p. 535).

4.29 Gatewood, B. E., "Inelastic Combined Thermal and Applied Stresses in Skin-Stringer Aircraft Structures" p. 212. A procedure for the successive approximation solution of the title problem employing approximate equations for the stress-strain relationship.

1958 - July

4.30 Morgan, A., "A Proof of Duhamels Analogy for Thermal Stresses" p. 446.

1958 - August

4.31 Johns, D. J., "Approximate Formulas for Thermal-Stress Analysis" p. 524-525. Derivation of the thermal stress distributions in a typical I-section using assumptions similar to those of Biot.

1958 - Sept.

4.32 Singer, J., "Thermal Buckling of Solid Wings of Arbitrary Aspect Ratio" p. 573-580, 590. Summarizes results of thermal buckling analyses of solid wings by Rayleigh-Ritz method.

4.33 Bijlaard, P. P., "Differential Equations for Cylindrical Shells With Arbitrary Temperature Distribution" p. 594-595. Derivation of the Differential Equations.

II.A.4.. Journal of the Aero/Space Sciences ("Journal of the Aeronautical Sciences" prior to July 1958) (Cont'd)

1958 - Oct.

4.34 Blisplinghoff, R. L., "Further Remarks on the Torsional Rigidity of Thermally Stressed Wings" p. 657; 658. Comparison of theory and experiment for finitely twisted flat plates subjected to a chordwise temperature distribution.

4.35 Boley, B. A., and Barrekette, E., "Thermal Stress in Curved Beams" p. 627-643. Analysis of thermoelastic stresses in curved beams of constant properties and constant cross section under temperatures varying in the radial direction only. Good agreement is found between stresses as calculated from elasticity theory and from strength-of-materials theory which assumes that plane sections remain plane. A comparison with the corresponding straight beam formula is also included.

4.36 Herrmann G., "On a Complimentary Energy Principle in Thermoelasticity" p. 660.

1958 - Nov.

4.37 Forray, M., "Thermal Stresses In Plates" p. 716, 717. Determination of stresses in a traction-free bulkhead subjected to a general two-dimensional temperature distribution.

1958 - Dec.

4.38 Brull, M., and Vinson, J., "Approximate Three-Dimensional Solutions for Transient Temperature Distribution in Shells of Revolution" p. 742-750.

1959 - Jan.

4.39 Johns, D. J., "Comment on - Thermal Buckling of Clamped Cylindrical Shells" (by W. Zuk, May 1957) p. 59. A modification of II.A.4.21 to include the effect of frame (or bulkhead) flexibility in the analysis, for critical buckling temperature.

1959 - Feb.

4.40 Naghdi, P. M., "On Thermoelastic Stress-Strain Relations for Thin Isotropic Shells" p. 125.

1959 - March

4.41 Basin, M., MacNeal, R., and Shields, J., "Direct Analog Method of Analysis of the Influence of Aerodynamic Heating on the Static Characteristics of Thin Wings" p. 145-154. Presents a general method of analysis of temperature effects on structures. The method is applied to a square, cantilever, constant - depth wing box, symmetrically heated along the leading and trailing edges. Thermal in-plane stresses and lateral load influence coefficients are determined with an electric analog computer.

II.A.4. Journal of the Aero/Space Sciences ("Journal of the Aeronautical Sciences" prior to July 1958) (Cont'd)

1959 - April

4.42 Bijlaard, P. P.: "Thermal Stresses and Deflections in Rectangular Sandwich Plates," p. 210-218. Expressions are developed for bending moment, torsional moment and transverse shear in a rectangular sandwich plate subjected to a temperature differential between the upper and lower surfaces. Shear deformation of the core is considered. Boundary conditions treated include: Two opposite edges simply supported with the other two free or clamped; three edges simply supported with the other edge free.

1959 - May

4.43 Forray, M., "Thermal Stresses in Rings" p. 310-311. Extension of II.A.4. 37 to rings or frames of the type common in semimonocoque type construction of vehicles.

1959 - June

4.44 Baltrukonis, J. H., "Comparison of Approximate Solutions of the Thermoelastic Problem of the Thick-Walled Tube" p. 329-334. Axially symmetric, steady-state temperature distribution is assumed. Thermal stresses are calculated, taking variation with temperature of elastic and thermal properties of the material into account. Five methods are compared.

1959 - July

4.45 Biot, M. A., "New Thermomechanical Reciprocity Relations with Application to Thermal Stress Analysis" p. 7, 401-408. Based on the variational formulation of linear thermodynamics, thermomechanical reciprocity relations are discussed which lead to new methods of analysis of thermal stress. The results are applicable to stationary and transient temperatures in elastic and viscoelastic structures, and do not require the evaluation of the temperature field.

1959 - Dec.

4.46 Gerard, G., and Tramposch, H., "Photothermoelastic Investigation of Transient Thermal Stresses in a Multiweb Wing Structure" p. 783-786. Presents the results of experimental studies and compares them with the results of a theoretical analysis. Experimental procedures are fully described.

4.47 Abir, D., and Nardo, S. V., "Thermal Buckling of Circular Cylindrical Shells Under Circumferential Temperature Gradients" p. 803-808. Analysis of the title problem using Donnell's equation. The variation of the thermal stress with the circumferential coordinate is represented by Fourier series. Conclusion is that the axial buckling stress under variable thermal stress conditions is close to critical stress for uniform axial

II.A.4. Journal of the Aero/Space Sciences ("Journal of the Aeronautical Sciences" prior to July 1958) (Cont'd)

4.47 (Cont) compression if the intensity of the thermal stress is not large within a half-wavelength of the buckling pattern.

1960 - Feb.

4.48 Turner, M. J., Dill, E. H., Martin, H. C., and Melosh, R. J., "Large Deflections of Structures Subjected to Heating and External Loads" p. 97-106, 127. The method of direct formulation of the stiffness matrix is extended to include the effects of nonuniform heating and large deflection. The necessary force-deformation relations are derived for an axially loaded member and for a plate element.

1960 - March

4.49 Forray, M., "Formulas for the Determination of Thermal Stresses in Rings" p. 238-240. Equations are presented for the determination of polar-coordinate stress components for the plane-stress linear elastic solution of a traction free circular ring subjected to a general two-dimensional temperature distribution.

1960 - May

4.50 Johns, D. J., "Thermal Stresses in a Long Circular Shell with Axial Temperature Variation" p. 393, 394. Analysis of the discontinuity stresses occurring at the junction of a shell with another member having different thermal expansion properties and/or temperature distributions. Thermal stresses are calculated for the bulkhead and the cylinder. Cylinder calculations are made for both the simply supported and clamped edge conditions.

1960 - June

4.51 Gatewood, B. E., "The Problem of Strain Accumulation Under Thermal Cycling" p. 461-462. An average stress against strain for various numbers of cycles, including elastic shakedown at which point this strain growth or accumulation ceases is presented. These curves may be used for design just as ordinary stress-strain curves. They give the allowable stress on the total cross section for any desired permanent set with due allowance for temperature effects on material properties, thermal stresses, and inelastic effects. No creep is considered.

4.52 Forray, M., "Table for Thermal Stresses in Rings" p. 478-479. Presents a tabular set of quantities for the direct calculation of the stress components given by formulas in reference II.A.4.49.

II.A.4. Journal of the Aero/Space Sciences ("Journal of the Aeronautical Sciences" prior to July 1958) (Cont'd)

1960 - August

4.53 Crichlow, W. J., and Haggenmacher, G. W., "The Analysis of Redundant Structures by the Use of High Speed Digital Computers" p. 595-606, 614. Discusses the use of the matrix force method for the analysis of complex redundant structures. Treatment of thermal expansion and plasticity is included.

1960 - Sept.

4.54 Forray, M., and Newman, M., "Axisymmetric Bending Stresses in Solid Semicircular Plates with Thermal Gradients" p. 717-718. Presents charts for the solution of the title problem with a clamped or simply supported boundary.

1960 - Oct., Nov., Dec.

4.55 Newman, M., and Forray, M., "Bending Stresses Due to Temperature in Hollow Circular Plates" Part I p. 792-793 (Oct.), Part II p. 870-871 (Nov.), and Part III p. 951-952 (Dec.). Presentation of nondimensional deflection, moments, and shears in a circular plate with a concentric hole subject to a linear thermal gradient throught the thickness.

1961 - April

4.56 Miura, K., "Thermal Buckling of Rectangular Plates" p. 341, 342. Analysis of the thermal buckling of a plate simply supported by the web and subjected to an arbitrary symmetrical midplane temperature distribution. The buckling criterion and an associated simple formula are determined. (Summary of work described in III.C.3.6)

1961 - June

4.57 Chang, C. C., and Ebcioglu, I. K., "Thermoelastic Behavior of a Simply Supported Sandwich Panel Under Large Temperature Gradient and Edge Compression" p. 480-492. The thermal and elastic behavior of a retangular sandwich panel subjected to edge compression, transverse load, and a temperature difference between the two faces. A variational principle is used to obtain the differential equations and boundary conditions. An analytic theory is given for the case of a simply supported panel.

4.58 Gatewood, B. E., Grotehouse, A., and Van Hausen, W., "Experimental Data on Strain Accumulation Under Equivalent Thermal Cycling", p. 502-503. Test results which verify the effects of thermal cycling predicted in reference II.A.4.51 are presented.

1961 - Oct.

4.59 Forray, M., and Newman, M., "Bending of Circular Plates Due to Asymmetric Temperature Distribution" p. 773-778. Analysis of the bending of

II.A.4. Journal of the Aero/Space Sciences ("Journal of the Aeronautical Sciences" prior to July 1958) (Cont'd)

a circular plate subjected to a thermal gradient which varies linearly through its thickness and is asymmetric over its surface. General equations, applicable to both the solid plate and the plate with a concentric hole, are presented. A detailed solution and nondimensional design curves are given for the clamped, solid circular plate.

1961 - Nov.

4.60 Levinson, M., "Thermal Stresses in an Idealized Wing Structure" p. 899-901. Demonstrates the use of Biot's variational principle of heat flow in the computation of thermal stresses in an idealized wing structure due to aerodynamic heating.

1962 - February

4.61 De Silva, C. N.: "Thermal Stresses in the Bending of Ogival Shells" p. 207-212. Considers the bending of ogival shells under temperature gradients by means of the differential equations of the axisymmetric small deflection theory of thin elastic shells of revolution. An example is worked out in detail in order to illustrate quanititatively the stresses caused by a specified temperature rise.

1962 - March

4.62 Gatewood, B. E., and Gehring, R. W.: "Inelastic Redundant Analysis and Test-Data Comparison for a Heated Ring Frame" p. 364.

4.63 Newman, M., and Forray, M.: "Thermal Stresses and Deflections in Thin Plates with Temperature-Dependent Elastic Moduli." p. 372, 373. Derivation of equations for the stresses and deflections of thin plates caused by temperature gradients through the thickness of the plates.

1962 - May

4.64 Gatewood, B. E., and Gehring, R. W.: "Allowable Axial Loads and Bending Moments for Inelastic Structures under Nonuniform Temperature Distribution" p. 513-520. A strain-analysis method is derived and demonstrated for the calculation of design allowable load-strain curves for the cross section of a structure supporting axial loads and bending moments.

1962 - May

4.65 Forray, M. and Newman, M.: "Thermal Stresses and Deflections in Elastically Supported Plates." p. 611, 612. Extension of a previous analysis of elastically supported rectangular plates subjected to linear temperature gradients throughout the thickness, to cover the case where two opposite edges of such a plate are supported by beams of equal rigidity. Graphical results for the deflections and moments are presented.

II.A.4. Journal of the Aero/Space Sciences ("Journal of the Aeronautical Sciences" prior to July 1958) (Cont'd)

1962 - June

4.66 Tramposch, H.: "Theroretical and Experimental Investigation of Thermal Stresses in Hypersonic-Aircraft Wing Structures." p. 719-725, 742. Development of a simple and relatively accurate analytic approximation for the determination of the temperature and thermal-stress distribution in aircraft wing structures. Refined photothermoelastic experiments are used to verify the results.

1962 - July

4.67 Shaffer, B. W. and Levitsky, M.: "Thermal Bond Stresses in Case-Bonded Viscoelastic Propellant Discs" p. 827-833. Expressions are derived for the thermal stresses in the bond between a visco-elastic propellant and its surrounding elastic casing, under conditions of plane stress.

1962 - August

4.68 Dugundji, J. and Calligeros, J. M.: "Similarity Laws for Aerothermoelastic Testing" p. 935-950. The similarity laws for aerothermoelastic testing are presented for the range $M < 3.5$, $T < 1{,}000^{\circ}F$. These are obtained by making nondimensional the appropriate governing equations of the individual external aerodynamic flow, heat conduction tothe interior, and stress-deflection problems which make up the combined aerothermoelastic problem. For the general aerothermoelastic model, where the model is placed in a high-stagnation-temperature wind tunnel, similitude is shown to be very difficult to achieve for a scale ratio other than unity. Means of dealing with this basic conflict are presented.

1962 - September

4.69 Newman, M. and Forray, M.: "Axisymmetric Large Deflections of Circular Plates Subjected to Thermal and Mechanical Loads" p. 1060-1066. Develops an exact mathematical formulation for deflection of circular plates with in-plane edge restraint, within the framework of von Karman's large strain-displacement relations. Numerical results in nondimensional graphical form, obtained for a range of temperature and load parameters, are given for the special case of a simply supported circular plate with full boundary restraint to radial movement, subjected to arbitrary temperature variation and uniform pressure through the thickness.

1962 - October

4.70 Forray, M. and Newman, M.: "The Postbuckling Analysis of Heated Rectangular Plates" p. 1262.

1962 - November

4.71 Das, Y. C., and Navaratna, D. R.: "Thermal Bending of Rectangular Plate", pp. 1397-1399.

II.A.5. Journal of Applied Mechanics (Transactions ASME)

1954 - March

5.1 Bogdanoff, J., "Note on Thermal Stresses", p. 88. Emphasizes the utility of complex potentials in solving two-dimensional thermal-stress problems.

1955 - June

5.2 Sadowsky, M.A., "Thermal Shock on a Circular Surface of Exposure of an Elastic Half-Space" p. 177-182.

5.3 Durelli, A., and Tsau, C., "Determination of Thermal Stresses in 3-Ply Laminates" p. 190-192. Presents the results of a photo elastic investigation of the thermal stresses produced in a 3-Ply laminate consisting of glass, polyvinyl butyral, glass, when the temperature drops slowly from 70 to -20°F.

1955 - Sept.

5.4 Born, J., and Horvay, G., "Thermal Stresses in Rectangular Strips - II" p. 401-406. Stresses and deformations in rectangular strips due to various longitudinal temperature distributions are presented in formulas, tables, and graphs. The results are important for slabs, plate assemblies, rectangular ducts, tube-sheet ligaments; they apply, in a more qualitative fashion, also to cylindrical bodies.

1955 - Dec.

5.5 Williams, M.L., "Large Deflection Analysis for a Plate Strip Subjected to Normal Pressure and Heating" p. 458-464. Development of a simple relation for calculating the deflection and the membrane stresses for an infinite strip with the end points fixed in space. Calculations for the specific cases of both clamped and simply supported plates subjected to a uniform pressure and uniform temperature rise are included.

1956 - Sept.

5.6 Weiner, J., "An Elastoplastic Thermal Stress Analysis of a Free Plate" p. 395-402. Thermal stresses are determined in a free plate of elasto-plastic material subjected to a varying heat input over one face. A solution is first found by suitable modifications of the known elastic solution. Residual stresses are determined and found to depend markedly on the peak magnitude of the heat input.

1956 - Dec.

5.7 Sharma, B., "Thermal Stresses in Infinite Elastic Disks" p. 527-531. Analytical method for solving thermal stresses due to any temperature distribution, in infinite elastic discs. Discussion of the steady state leads to solutions for a disc of finite thickness and infinite radius whose stresses are attributable to axisymmetric temperature distribution, and for a semi-infinite solid in which the elastic properties change at a specified depth.

II.A.5. Journal of Applied Mechanics (Transactions ASME) (Cont'd)

1957 - Sept.

5.8 McDowell, E.L., and Sternberg, E., "Axisymmetric Thermal Stresses In a Spherical Shell of Arbitrary Thickness" p. 376-380. Explicit series solution for the steady-state thermal stresses and displacements induced in a spherical shell by an arbitrary, axisymmetric distribution of surface temperatures.

5.9 Hoff, N.J., "Buckling of Thin Cylindrical Shell Under Hoop Stresses Varying in Axial Direction" p. 405-412. The buckling of a thin cylindrical shell simply supported along the perimeter of its ends is analyzed under hoop compressive stresses varying in the axial direction. Thermal stresses resulting from a uniform increase in the temperature of the cylinder are determined. Simple approximate formulas are developed for buckling stress and thermal stress.

5.10 Boley, B.A., and Barber, A., "Dynamic Response of Beams and Plates to Rapid Heating" p. 413-416. Studies the thermally induced vibrations of rectangular plates and beams under some typical heat applications. The basic parameter of the problem, B, is found to depend on the natural frequency of the structure and on a characteristic thermal time. Curves are presented of the variation with B of the ratio of the deflections calculated including and neglecting the effect of inertia.

5.11 Goodier, J.N., "Thermal Stress and Deformation" p. 467-479. Contribution to the "Design Data" series. A compilation of formulas, equations, etc. for thermal stress problems.

1958 - March

5.12 Sharma, B., "Thermal Stresses in Transversely Isotropic Semi-Infinite Elastic Solids" p. 86-88.

5.13 Hammitt, F.G., "Axial Temperature Gradient Bending Stresses in Tubes". p. 109-114. A study of the bending stresses induced in a thin-walled tube adjacent to a joint between the tube and a heavier section by an axial temperature gradient imposed across the assembly. Approximate methods are developed for the calculation of stress and wall thickness under conditions in which the wall thickness is varied in each instance to give (a) constant radius of curvature, (b) constant stress, and (c) arbitrary stress distribution.

II.A.5. Journal of Applied Mechanics (Transaction ASME) (Cont'd)

1958 - June

5.14 Williams, M.L., "Further Large Deflection Analysis for a Plate Strip Subjected to Normal Pressure and Heating". p. 251-258. An extension of II.A.5.5 to include an arbitrary temperature distribution in the thickness direction of the plate. Presents design charts convering equilibrium positions in the buckling as well as nonbuckling range and showing maximum stress and central deflection as a function of pressure, average temperature, and temperature moment for clamped and simply supported edges.

1958 - Dec.

5.15 Landau, H., and Weiner, J.H., "Transient and Residual Stresses in Heat Treated Plates" p. 459-465.

5.16 Poritsky, H., and Fend, F.A., "Relief of Thermal Stresses Through Creep" p. 589-597.

5.17 Yuksel, H., "Elastic, Plastic Stresses in Free Plate With Periodically Varying Surface Temperature" p. 603-606. Concerned with an elastic, perfectly plastic free plate subjected to a harmonically varying temperature at one face while the other face is kept at constant temperature and the edge is perfectly insulated. The thermal stresses associated with the steady-state temperature oscillations are analyzed and the development of plastic regions is discussed.

5.18 Clark, S.K., and Hess, R.L., "Transient Thermal Stresses by an Analogy" p. 627-628. An analogy is developed between controlled water-vapor diffusion in organic materials and the transient thermal stress problem.

1959 - March

5.19 Weiner, J.H., and Huddleston, J.V., "Transient and Residual Stresses in Heat Treated Cylinders" p. 31-39. Analytical approach using the theory of plasticity for both solid and hollow cylinders. Equations are derived on the basis of the Tresca yield condition and a Poisson ratio of 0.5.

5.20 Han. L.S., and Bergman, K., "Thermally Induced Twist in Plates of Thin Cross Section" p. 134-135.

5.21 Tsao, C.H., "Thermal Stresses in Long Cylindrical Shells" p. 147-148. Goodier's results (II.A.5.11) for the longitudinal thermal stresses in long cylindrical shells are improved by the addition of a few terms.

1959 - June

5.22 Florence, A.L., and Goodier, J.N., "Thermal Stress at Spherical Cavities and Circular Holes in Uniform Heat Flow".

II.A.5. Journal of Applied Mechanics (Transaction ASME) (Cont'd)

1959 - Sept.

5.23 Gatewood, B.E., "Thermal Stresses in Moderately Thick Elastic Plates" p. 432-436. A three-dimensional analysis is made of thermal stresses in moderately thick elastic plates, based on the assumption that the normal stress in the thickness direction and the temperature are polynomial functions of the thickness coordinate.

1959 - Dec.

5.24 Nelson, C.W., "Thermal Stresses Owing to a Hot Spot in a Rectangular Strip" p. 488-490. Problem is solved by superposition of the solutions for a radially symmetric hot spot in an infinite plate and a system of correction stresses.

5.25 Sternberg, E., and Chakravorty, J., "On Inertia Effects in a Transient Thermoelastic Problem" p. 503-504. Dynamic solution for transient thermoelastic problem of semispace constrained against transverse displacements and subjected to uniform time-dependent heat flux on entire boundary.

5.26 Nowinski, J., "Note on a Thermoelastic Problem for a Transversely Isotropic Hollow Sphere Embedded in an Elastic Medium" p. 649-650. Generalization of the Galerkin problem to consider thermoelastic stresses in anisotropic bodies with an axis of symmetry.

1960 - March

5.27 Tramposch, H., and Gerard, G., "Correlation of Theoretical and Photo-thermoelastic Results in Thermal Stresses in Idealized Wing Structures" p. 79-86. Demonstrates by means of simple cemented models that the photothermoelastic technique yields reliable thermal stress results. The technique is then used to obtain transient thermal stresses in built up models which are representative of idealized wing structures subject to aerodynamic heating.

5.28 Jaunzemis, W., and Sternberg, E., "Transient Thermal Stresses in a Semi-Infinite Slab" p. 93-103. Analytical investigation of transient temperature and thermal stress distribution in an unrestrained semi-infinite slab with insulated faces when a finite segment of its edge is subjected to a sudden uniform change in temperature.

1960 - June

5.29 Landau, H.G., Weiner, J.H., and Zwicky, E.E., "Thermal Stress in a Viscoelastic Plastic Plate With Temperature Dependent Yield Stress" p. 297-302.

II.A.5. Journal of Applied Mechanics (Transaction ASME) (Cont'd)

5.30 Han, L.S., "An Approximate Analysis of the Influence of Aerodynamic Heating and Initial Twist on the Torsional Stiffness of Thin Wings" p. 332-334. Approximate formulas, valid for wings with large aspect ratios, are derived, based on the fiber stress concept, for the combined influence of aerodynamic heating and initial twist on the torsional stiffness of a thin wing.

1960 - Sept.

5.31 Barrekette, E., "Thermoelastic Stresses in Beams" p. 465-473. Method of successive approximation for the solution of the equations governing the behavior of elastic, free beams of arbitrary constant cross section under an arbitrary temperature distribution.

5.32 Landau, H., and Zwicky, E., "Transient and Residual Thermal Stresses in an Elastic-Plastic Cylinder" p. 481-488. Equations for the stress rates in solid cylinders subject to transient temperature distributions are presented, based on the assumption of an elastic, perfectly plastic material obeying a von Mises temperature-dependent yield criteria.

1960 - Sept.

5.33 Cowper, G.R., "The Elastoplastic Thick-Walled Sphere Subjected to a Radial Temperature Gradient" p. 496-500

1960 - Dec.

5.34 Hwang, C., "Thermal Stresses in an Elastic Work-Hardening Sphere" p. 629-634. Method for obtaining the transient thermal-stress distribution and the residual stresses in a spherical body where the time-dependent temperature distribution is symmetrical with respect to the center of the sphere.

5.35 Goodier, J.N., and Florence, A., "Thermal Stresses Due to Disturbance of Uniform Heat Flow by an Insulated Ovaloid Hole" p. 635-639. Solution to the linear thermoelastic problem for the case of a uniform heat flow disturbed by a hole of ovaloid form, which includes the ellipse and circle as special cases. Results for stress and displacement are found in closed form by reducing the problem to one of boundary loading, solvable by a method of Muskhelishvili.

1961 - March

5.36 Youngdahl, C., and Sternberg, E., "Transient Thermal Stresses in a Circular Cylinder" p. 25-34. Solution for the transient temperature distribution and accompanying quasi-static thermal stresses and deformations, which arise in an infinitely long elastic circular shaft if its surface temperature undergoes a sudden uniform change over a finite band between two cross sections and is steadily maintained thereafter.

II.A.5 Journal of Applied Mechanics (Transaction ASME) (Cont'd)

5.37 Tramposch, H., and Gerard, G., "An Exploratory Study of Three-Dimensional Photothermoelasticity" p. 35-40.

5.38 Deresiewicz, H., "Thermal Stress in a Plate Due to Disturbance of Uniform Heat Flow by a Hole of General Shape" p. 147-149.

1961 - June

5.39 Muki, R., and Sternberg, E., "On Transient Thermal Stresses in Viscoelastic Materials with Temperature Dependent Properties" p. 193-207.

1961 - Sept.

5.40 Flieder, W.G., Loria, J.C., and Smith, W.J., "Bowing of Cryogenic Pipelines" p. 409-416.

5.41 Parker, E.W., "The Stresses in an Elastoplastic Bar Subjected to a Sudden Change of Surface Temperature" p. 434-438.

1961 - Dec.

5.42 Riney, J.D., "Disk Heated by Internal Source" p. 631-632.

1962 - March

5.43 Onat, E.T. and Yamanturk, S., "On Thermally Stressed Elastic-Plastic Shells." p. 108-114. Analysis of the elastic-plastic behavior of rotationally symmetric sandwich shells in the presence of thermal effects arising from thermal straining and the temperature-dependence of the yield strength. The mathematical aspects of the problem are discussed for the case of cylindrical shells.

5.44 Mendelson, A. and Spero, S.W., "General Solution for the Elasto-plastic Thermal Stresses in a Strain Hardening Plate with Arbitrary Material Properties" p. 151-158.

1962 - Sept.

5.45 Sih, G.C., "Singular Character of Thermal Stresses Near a Crack Tip" p. 587-589.

6. Journal of the Mechanics and Physics of Solids

1956 - Nov.

6.1 Lessen, M., "Thermoelasticity and Thermal Shock" p. 57-61.

II.A.6. Journal of the Mechanics and Physics of Solids (Cont'd)

1959 - March

6.2 Lessen, M., "Thermoelastic Waves and Thermal Shock" p. 77-84. Derivation of the field equations governing the small displacements of a thermoelastic solid and investigation of the properties of plane thermoelastic waves. Thermal shock solutions are developed using the thermoelastic wave solutions, and the problem of thermal shock in an infinite cylinder is considered.

1959 - June

6.3 Knops, R.J., "A Method for Solving Linear Thermoelastic Problems" p. 182-192. Inverse method for utilizing known isothermic solutions for the derivation of solutions of thermoelastic problems.

1961 - July

6.4 Hilton, H.H., and Russell, H.G., "An Extension of Alfrey's Analogy to Thermal Stress Problems in Temperature Dependent Linear Viscoelastic Media" p. 152-164. An extension of the Alfrey analogy between stress and strain in homogeneous linear viscoelastic media and elastic stress and strain with a time-response function to account for three-dimensional thermal stresses in materials in which nonhomogeneity is caused by temperature variation.

6.5 Flavin, J.N., and Green, A.E., "Plane Thermoelastic Waves in an Initially Stressed Medium" p. 179-190. Studies the propagation of plane, small-amplitude waves in a homogeneous, isotropic solid subjected to large uniform extensions at constant temperature, in three orthogonal directions, such that two of the extension ratios are equal.

6.6 Deresiewicz, H., "A Note on Thermoelastic Rayleigh Waves" p. 191-195. Study of waves propagated on the surface of an elastic thermally conducting medium, demonstrating the frequency dependence of phase velocity and amplitude attenuation.

1962 April/June

6.7 Chedwick, P., "On the Propagation of Thermoelastic Disturbances in Thin Plates and Rods" p. 99-110.

6.8 Dillon, O.W., Jr., "A Nonlinear Thermoelastic Theory" p. 123-132.

7. Journal of the Royal Aeronautical Society

1955 - Sept.

7.1 Walker, P.B., "The Structural Effects of Kinetic Heating in Supersonic Flight" p. 581. Survey paper.

II.A.7. Journal of the Royal Aeronautical Society (Cont'd)

1956 - Dec.

7.2 Przemieniecki, J., "Transient Temperature Distributions and Thermal Stresses in Fuselage Shells with Bulkheads or Frames" p. 799-804. Presents diagrams for calculating maximum thermal stresses and the stress-time variation for various rates of aerodynamic heat input to the fuselage skin.

1957 - Nov.

7.3 Hoff, N.J., "Buckling at High Temperature" p. 756-774. Survey of the influence of temperature and temperature gradients on the buckling of columns, plates, and cylindrical shells.

1958 - Feb.

7.4 Kitchenside, A.W., "The Effects of Kinetic Heating on Aircraft Structures" p. 105. A survey paper.

1958 - March

7.5 Legg, K., and Stevens, G., "Temperature Distributions in Aircraft Structures and the Influence of Mechanical and Physical Properties" p. 174-186. Discussion of the origin of thermal effects, evaluation of difficulties encountered in a formal analysis of heat conduction problems, and presentation of several examples illustrating the use of finite difference methods. Data are also presented for some pertinent physical and mechanical properties of materials including thermal expansion, conductivity, diffusivity, creep, fatigue, specific strength and stiffness, and a parameter called the "thermal stress efficiency".

1958 - Dec.

7.6 Broadbent, E.G., "Aeroelastic Problems Associated With High Speeds and High Temperature" p. 867. Two simple examples are given. The first relates to static distortion of a solid wing at high temperature using geometrically nonlinear relations. The second example shows that chordwise distortion can reduce the flutter speed of a flat plate.

1959 - Nov.

7.7 Przemieniecki, J.S., "The Structural Effects of Kinetic Heating - Design of Transparencies" p. 620-636. Study of the design problems in transparencies for supersonic aircraft. Topics considered include thermal deformation and thermal stresses, including the interaction with pressure loadings.

II.A.7. Journal of the Royal Aeronautical Society (Cont'd)

1959 - Nov.

7.8 Sobey, A.J., "The Structural Effects of Kinetic Heating - Advantages and Limitations of Models" p. 646-656. Use of models for structural tests under kinetic heating conditions is examined. Treats the similarity criteria relative to external air flow, internal heat transfer, and elastic response.

1959 - Nov.

7.9 Michael, M.E., and Bruce, J., "The Structural Effects of Kinetic Heating - Summary of the Discussion" p. 656-658.

1960 - March

7.10 McKenzie, K., "The Buckling of a Circular Plate With a Concentric Circular Hot-Spot" p. 105-106. Calculation of the critical temperature for a clamped plate supported in such a way that the radial stress in the cold part obeys the inverse square law.

1961 - Jan.

7.11 Lieb, B., "Cylindrical Bending of a Heated Long Rectangular Plate" p. 26-30. Method of analysis for prediction of thermal stresses and deflection in heated, long rectangular plates. Also predicts the determination of the maximum loads imposed on the supporting members by the plate due to its thermal deformations. Temperature and deflection are assumed constant in the spanwise direction.

1961 - Feb.

7.12 James, D., "Kinetic Heating in Relation to Structural Integrity" p. 80-82. Discussion of the kinetic heating aspect of structural design of supersonic transports, stressing the necessity of assessing the degree to which past experience is relevant if excess weight is to be avoided. Attention is concentrated on the Mach 2 class of airplane constructed largely of aluminum alloy.

1961 - July

7.13 Vasudevan, M., and Johnson, W., "Thermal Bending of a Tri-Metal Strip" p. 507-509. Elastic analysis for the bending of a tri-metallic strip under uniform heating under the assumption of elementary bending and extension. Explicit equations for the three thrusts and the curvature are given for the most general combination of material properties and thicknesses.

1962 - April

7.14 Williams, D., "Spar-Web Design in Relation to Thermal Stresses, the Corrugated Web" p. 226-230.

II.A.8. Transactions ASME (Not Including Journal of Applied Mechanics)

1956 - April

8.1 Coffin, L.J., "Design Aspects of High-Temperature Fatigue With Particular Reference to Thermal Stresses" p. 527-531. Analysis of a design criterion for fatigue of structural components under conditions of cyclic elevated temperatures.

1956 - April

8.2 Mendelson, A., and Manson, S.S., "Approximate Solution to Thermal Shock Problems in Plates, Hollow Spheres, and Cylinders With Heat Transfer at Two Surfaces" p. 545-553.

1956 - July

8.3 Randall, P.N., and Lang, H.A., "Thermal Cycling Test of a Hot Spot in a Vessel" p. 1003-1010.

1956 - July

8.4 Bergman, D.J., "Some Cases of Stress Due to Temperature Gradient" p. 1011-1019. A qualitative analysis of the stress due to a maintained temperature differential in a flat bar is given for both a free and a restrained bar, and extended to the cases of a flat plate and a thick pipe.

1957 - July

8.5 Schnitt, A., Brull, M., and Wolko, H.S., "Optimum Stresses of Structural Elements at Elevated Temperatures" p. 959-966. Method by which optimum stress curves for a given material at any temperature may be calculated from the room-temperature optimum-stress curves for a different material. The only data required to perform this transformation are stress-strain curves of both materials.

8.6 Gerard, G., "Thermostructural Efficiencies of Compression Elements and Materials" p. 967-973. Equations relating minimum weight of compression elements to structural loading intensity are derived and used to construct charts from which the most efficient structural configuration and material for carrying compression loads can be determined.

8.7 Goldin, R., "Design Criteria for Heated Aircraft Structures" p. 980-985.

8.8 Goldman, G.M., "Discussion of Safety-Factor Requirements for Supersonic Aircraft Structures" p. 986-989. The design problems including temperature effects are summarized and the type of safety allowance needed for each is indicated.

8.9 Mar, J.W., and Schmit, L.A., "Some Structural Penalties Associated With Thermal Flight" p. 990-1004.

II.A.8. Transactions ASME (Not Including Journal of Applied Mechanics) (cont'd)

8.10 Brouns, R.C., and Baird, R.B., "Aircraft Structural Testing Techniques at Elevated Temperatures" p. 1005-1013. A review of some of the test system requirements and problems associated with structural testing of aircraft at elevated temperatures.

8.11 Duberg, J.E., "Some NACA Research on Effect of Transient Heating on Aircraft Structures" p. 1014-1018. Description of a radiant heating apparatus to simulate aerodynamic heating. Discusses the effects of thermal stresses on the stiffness and deflection of aircraft structures as demonstrated by tests using the apparatus.

1958 - Feb.

8.12 Merckx, K.R., "The Time and Temperature Dependence of Thermal Stresses in Cylindrical Reactor Fuel Elements" p. 505-509. Develops a method for calculating thermal stress in subject components that includes inelastic behavior.

1958 - July

8.13 Merckx, K.R., "The Dependence of Thermal Stresses in Cylindrical Reactor Fuel Elements Upon the Method of Cooling" p. 985-990. Method of computing thermal stresses and strains during operation of reactor fuel elements.

1958 - Oct.

8.14 Chen, S.Y., "Transient Temperature and Thermal Stresses in Skin of Hypersonic Vehicle With Variable Boundary Conditions". Solution for temperatures and stresses in slab insulated on one side with one-dimensional heat flow.

After December 1958, the following series of journals comprise the ASME Transactions (not including the Journal of Applied Mechanics).

Journal of Engineering for Power (Series A)
Journal of Engineering for Industry (Series B)
Journal of Heat Transfer (Series C)
Journal of Basic Engineering (Series D)

1959 - June - Journal of Basic Engineering

8.15 Miller, D.R., "Thermal Stress Ratchet Mechanism In Pressure Vessels" p. 190-196. The combination of cyclic thermal stresses and sustained internal pressure in a vessel is shown to be a source of progressive expansion of the vessel if the stresses are sufficiently high.

II.A.8. Transaction ASME (Not Including Journal of Applied Mechanics) (cont'd)

1959 - Oct. - Journal of Engineering for Power

8.16 Kraus, H., and Sonnemann, G., "Stresses in Hollow Cylinder Due to Asymmetrical Heat Generation" p. 449-454. Equations are derived for the radial, tangential, shear, and axial stresses arising in nuclear reactor vessels, thermal shields, etc. from internal heat generation.

1960 - Feb. - Journal of Engineering for Industry

8.17 Weil, N.A., and Murphy, J.J., "Design and Analysis of Welded Pressure Vessel Skirt Supports" p. 1.

1960 - June - Journal of Basic Engineering

8.18 Merckx, K.R., "Cyclic Operation of Pressure Piping With Gamma Heating" p. 447-452. An elastic-plastic analysis for an internally cooled pressure tube with uniform heat generation. Defines the location of the elastic-plastic boundary in the tube wall.

8.19 Traexler, J.F., "Design of Pressurized Cylinder for High Temperature Applications" p. 477. General equations for the stresses in a thick-walled cylinder in a state of plane strain are derived considering "steady state" creep.

1960 - Nov. - Journal of Heat Transfer

8.20 Schmidt, J.E., and Sonnemann, G., "Transient Temperature and Thermal Stresses in Hollow Cylinders Due to Heat Generation" p. 273-278. Solutions for circular cylinders with internal heat generation varying exponentially with the radius, obtained by the use of Hankel transforms.

1960 - Nov. - Journal of Engineering for Industry

8.21 Zaid, M., and Forray, M., "Deformation and Moments in Elastically Restrained Circular Plates Under Arbitrary Load or Linear Thermal Gradient" p. 423-438. A combined graphical-analytical approach to the problem of a circular plate with a central hole, elastically constrained against rotation and deflection and subjected to a transverse linear temperature variation.

1961 - Nov. - Journal of Engineering for Industry

8.22 Bijlaard, P.P., and Dohrmann, R.J., "Thermal Stress Analysis of Irregular Shapes" p. 467-477. Finite difference method for determining the thermal stresses resulting from an axially symmetric temperature distribution in an irregularly shaped cylindrical vessel.

II.A.8. Transaction ASME (Not Including Journal of Applied Mechanics) (cont'd)

1962 - February - Journal of Engineering for Industry

8.23 Weil, N.A., "On Thermal Stresses in Cylinders Subjected to γ-Ray Heating" p. 35-41. Analysis of thermal stresses in an infinite cylinder, perfectly insulated on the outside, and subjected to internal heat generation by gamma irradiation.

8.24 Krause, I. and Shaffer, B.W. "Thermal Stresses in Spherical Case-Bonded Propellant Grains" p. 144-148. Expressions are derived for the bond stresses induced by a radially symmetric temperature distribution in spherical propellant grains bonded to spherical casings.

1962 - August - Journal of Engineering for Industry

8.25 Burton, P.; "Shrink Fits of Moderately Long Bands on Thin-Walled Cylinders" p. 338-342.

8.26 Becker, H.; "An Exploratory Study of Stress Concentrations in Thermal Shock Fields" p. 434-350.

1962 - October - Journal of Engineering for Power

8.27 Sinton, W. and Warner, R.E.: "Reducing Thermal Stress in Turbine Cylinders Subjected to Cyclic Service" p. 389-402.

II.A.9. Miscellaneous Periodical Literature

1954

9.1 Journal of the Franklin Institute, Nov., p. 371-382. Langhaar, H.L., and Stippes, M., "Three-Dimensional Stress Functions". The Maxwell stress functions are generalized to include steady-state temperature distributions. These functions satisfy Poisson-type differential equations for which a general solution is presented in terms of harmonic functions.

1955

9.2 Journal of the American Ceramic Society, Jan., p. 1-54. Kingery, W.D., (Edited by): A symposium on thermal fracture. A compilation of the following eight papers:

a. Kingery, W.D., "Recommended Letter Symbols for Thermal Stress Analysis"
b. Kingery, W.D., "Factor Affecting Thermal Stress Resistance of Ceramic Materials"
c, Buessem, W.R., "Thermal Shock Testing"
d. Manson, S.S., and Smith, R.W., "Theory of Thermal Shock Resistance of Brittle Materials Based on Weibull's Statistical Theory of Strength"

II.A.9. Miscellaneous Periodical Literature (cont'd)

e. Buessem, W.R., and Bush, E.A., "Thermal Fracture of Ceramic Materials Under Quasi-Static Thermal Stresses (Ring Test)"
f. Kingery, W.D., and Colbe, R.L., "Effect of Porosity on Thermal Stress Fracture"
g. Baroody, E.M., Simons, E.M., and Duckworth, W.H., "Effect of Shape on Thermal Fracture"
h. Crandall, W.B., and Ging, J., "Thermal Shock Analysis of Spherical Shapes"

1956

9.3 Jet Propulsion (Journal of the American Rocket Society)
Feb., p. 93-97.
Geckler, R.D., "Thermal Stresses in Solid Propellant Grains". Solution for a hollow cylinder insulated at the inner surface; outer surface is suddenly placed in a temperature environment different from the cylinder initial temperature. Assumes zero restraint to axial elongation and disregards end effects.

9.4 Journal of Applied Physics, March, p. 240-253.
Biot, M.A., "Thermoelasticity and Irreversible Thermodynamics". Presents a unified treatment of thermoelasticity by application and further developments of the methods of irreversible thermodynamics. The concept of thermal force is introduced by means of a virtual work definition. Heat conduction problems are formulated by the methods of matrix algebra and mechanics. Examples are presented and it is shown how the generalized coordinate method may be used to calculate the thermoelastic internal damping of elastic bodies.

9.5 Canadian Journal of Technology, Sept., p. 268-290.
Whalley, E., "The Design of Pressure Vessels Subjected to Thermal Stress. I. General Theory for Monoblock Vessels". Radial and circumferential stress components are determined for spherical and cylindrical pressure vessels subject to arbitrary radial temperature distributions and to internal and external pressures.

Whalley, E., "The Design of Pressure Vessels Subjected to Thermal Stress. II. Steady State Temperature Distribution" p. 291-303. The analysis of part I is specialized to steady-state temperature distributions.

9.6 Publication of the International Association of Bridge Structural Engineering, Vol. 16, p. 373-398. Nowacki, W., "The State of Stress in a Thin Plate Due to the Action of Sources of Heat". Determination of thermal stresses in a strip of plate with infinite lenght, a semi-infinite strip of plate, and a rectangular plate.

II.A.9. Miscellaneous Periodical Literature (cont'd)

1957

9.7 Quarterly of Applied Mathematics, Ja., p. 381-398. Sternberg, E., and McDowell, E.L., "On the Steady-State Thermoelastic Problem for the Half-Space.

9.8 Journal of Applied Physics, March, p. 364-366. Lessen, M., "Thermoelastic Damping at the Boundary Between Dissimilar Solids". Develops the thermoelastic equations for the general case of an initially stressed anisotropic substance, and discusses the propagation of a longitudinal wave normally across the interface between two such solids.

9.9 Product Engineering, June, p. 175-179.
Coffin, L.F., "Thermal Stress Fatigue". Defines a thermal shock parameter and explains the role of thermal cycling in fatigue. Test results are given to show material behavior. Design criteria and an example problem are included.

9.10 Electrical Energy (Great Britain), July, p. 343.
"Kinetic Heating Simulation in Aircraft Structures". Description of the development of a complete system for the laboratory simulation of the conditions likely to be met during high speed flight, and for the study of deformations caused by thermal stress where unequal temperature distributions result from changes in speed.

9.11 Journal of the American Ceramic Society, July, p. 24[illegible]-245.
Thompson, A.C., "Thermal Stresses Around a Heated Hole in a large Glass Plate". Treats the problem of sealing a hole in a cool glass plate under conditions at or above annealing temperatures by use of the equations for stresses in thin circular disks and the concept of a negative temperature distribution (a method of superposition used in stress analysis) that will represent the cooling.

9.12 Jet Propulsion, August, p. 872-876
Zwick, S.A., "Thermal Stresses in an Infinite, Hollow Case-Bonded Cylinder". Solves for the thermal stresses, due to a sudden temperature change, in an infinitely long, thick cylindrical tube, bonded at its outer surface to a thin cylindrical shell with a thermally insulated inner surface.

9.13 Jet Propulsion, August, p. 882-889.
Schneider, P.J., "Temperatures and Thermal Stresses in Transpiration Cooled Power-Producing Plates and Tubes." Solutions for eight special cases of transpiration-cooled porous plates and tubes generating uniform distributed heat.

II.A.9. Miscellaneous Periodical Literature (cont'd)

9.14 Jet Propulsion, Nov., p. 1157-1161.
Batdorf, S.B., "Structural Problems in Hypersonic Flight". A general review of the structural problems associated with hypersonic flight including thermal stresses, creep, and loss of strength and stiffness at elevated temperatures.

1958

9.15 Quarterly of Applied Mathematics, Jan., p. 381-393. Green, A.E., Rodok, J.R.M., and Rivlin, R.S., "Thermoelastic Similarity Laws".

9.16 Brown Boveri Review, Jan., p. 21-28. Endres, W., "Thermal Stresses Caused by Heating Thick-Walled Hollow Cylinders".

9.17 SAE (Society of Automotive Engineers) Journal, Jan., p. 46-49.
Sprague, G.H., and Huang, P.C., "Inelastic Design Steps Up Performance". Method for weight saving using inelastic designs for thermal stresses. Taking advantage of temperature gradient shapes can improve the efficiency of the structure within the limits of buckling strength and allowable deformation.

9.18 Machine Design, June-Sept.; A 22 part series -
See Reference II.A.9.23 and 9.29.
Manson, S. S., "Thermal Stresses in Design".

Part 1 - Appraisal of Brittle Materials, June 12, p. 114-120.
Part 2 - Quantitative Techniques for Brittle Materials, June 26, p. 99-108.
Part 3 - Basic Concepts of Fatigue in Ductile Materials, August 7, p. 100-107.
Part 4 - Causes of Fatigue in Ductile Materials, August 21, p. 110-113
Part 5 - Interpretation of Fatigue Data for Ductile Materials, Sept. 4, p. 126-133.

9.19 Journal of Nuclear Energy, Nov., p. 32-47.
Hillier, M. J., "Thermal Stresses in Reactor Shells Due to γ Irradiation". Formulas for calculating the temperatures and stresses in flat plates (restrained from bending) and cylindrical shells (away from ends) due to exponential heat generation arising from gamma heating.

9.20 Journal of the Institute of Metals, Vol. 87, p. 294-302.
Glenny, E., Northwood, J. E., Shaw, S. W. K., and Taylor, T. A., "A Technique for Thermal-Shock and Thermal-Fatigue Testing Based on the Use of Fluidized Solids". Description is given of the development of a laboratory test for studying the behavior of materials under conditions of

II.A.9. **Miscellaneous Periodical Literature (cont'd)**

9.20 (Cont'd)

transient thermal stress. The requirements of such a test are considered, and a number of possible methods of heating and cooling are reviewed.

1959

9.21 The Engineer (London), Jan., p. 56-57.
"Correlation of Thermal Stresses in Circular Cylinders and Flat Plates". Numerical results are presented for transient thermal stresses in hollow cylinders due to a step change in fluid temperature. Results are compared with solutions obtained elsewhere.

9.22 Journal of Nuclear Energy, Jan., p. 187-196.
Hillier, M. J., "Thermal Stresses in Reactor Shells Due to Thermal Neutron Irradiation"

9.23 Machine Design, Jan.-Nov., (A 22 part series - See Reference II.A.9.18 and 9.29)
Manson, S.S., "Thermal Stresses in Design"

Part 6 - Elastic Stress Analysis, Jan. 22, p. 126-131.
Part 7 - Exact and Approximate Solutions, Feb. 5, p. 114-121.
Part 8 - Elastic Stresses by Energy Methods, Feb. 19, p 156-160
Part 9 - Elastic Stress Solutions, March 5, p. 125-130.
Part 10 - Elastic Stresses by Minimizing Residuals, March 19, p. 191-197
Part 11 - Stresses Under Plastic Flow and Creep, July 9, p. 124-129.
Part 12 - Plastic Stresses and Strains by Successive Approximation, July 23, p. 144-150
Part 13 - Incremental Solutions for Plastic Stresses and Strains, Aug. 6, p. 127-133.
Part 14 - Strain Gage Measurements, Oct. 29, p. 109-116.
Part 15 - Strain Gage Applications, Nov. 12, p. 183-189.
Part 16 - Measurements by Photoelasticity, Nov. 26, p. 143-151.

9.24 Bulletin of the American Ceramic Society, March, p. 99-105.
Preist, D. H., and Talcott, R., "Thermal Stresses In Ceramic Cylinders Used in Vacuum Tubes". Develops a theory of stresses in terms of axial temperature gradients and the mechanical properties of the material and cylinder geometry for the particular case of cylinders with cooled ends and axisymmetric temperature distributions.

II.A.9. Miscellaneous Periodical Literature (cont'd)

9.25 ARS (American Rocket Society) Journal, April, p. 260-267.
Williams, M. L., "Some Thermal Stress Design Data for Rocket Grains".

1960

9.26 Journal of Applied Physics, Feb., p. 434 (Letters to the Editor).
Freudenthal, A. M., "Thermal Stress Analysis and Grueneisen's Relation".

9.27 Engineering, March, p. 369-370.
Newcomb, T. P., "Thermal Stress Behavior in Brake Drums".
Expressions are determined for stresses generated during a single brake application, and graphs showing the stress behavior in some typical automobile drums are given.

9.28 ARS (American Rocket Society) Journal, April, p. 366-368.
Ungar, E. E., and Shaffer, B. W., "Thermally Induced Bond Stresses in Case-Bonded Propellant Grains".

9.29 Machine Design, June-August, (A 22 part series - See Reference II.A.9.18 and 9.23)
Manson, S.S., "Thermal Stresses in Design".

Part 17 - Determining a Safe Working Stress, June 9, p. 159-165.
Part 18 - Working Stresses for Ductile Materials, June 23. p. 153-159.
Part 19 - Cyclic Life of Ductile Materials, July 7, p. 139-144
Part 20 - Thermal Cycling With Steady Stress, July 21, p. 161-167.
Part 21 - Effect of Mean Stress and Strain on Cyclic Life, August 4, p. 129-135.
Part 22 - Cumulative Fatigue Damage, Aug. 18, p. 160-166.

9.30 Quarterly of Applied Mathematics, July, p. 145-153.
Sneddon, I.N., and Lockett, F.J., "On the Steady-State Thermoelastic Problem for the Half-Space and the Thick Plate".

9.31 ARS (American Rocket Society) Journal, August, p. 778.
Parr, C.H., "Stress-Strain Equations for Case-Bonded Solid Propellant Grains".

9.32 ARS (American Rocket Society) Journal, Nov., p. 1041-1046.
Sibiriakov, V.A., "Determination of Temperature Induced Stresses in a Conical Shell". (Translation from the Russian Bull. of Institutions of Higher Learning, Aviation Technology Series, No. 1, 1960 p. 72-82).
Considers the determination of temperature induced stresses in a structurally orthotropic circular conical shell - assumes that the internal stresses in a thermally elastic free shell can be caused only by that part of the thermal load which corresponds to a bimoment state of the shell.

II.A.9. Miscellaneous Periodical Literature (cont'd)

1961

9.33 Quarterly Journal of Mechanics and Applied Mathematics, Feb., p. 75-84. Nariboli, G.A., "Spherically Symmetric Thermal Shock in a Medium With Thermal and Elastic Deformations Coupled". Examines the effect of an instantaneous temperature rise at the walls of a spherical cavity embedded in an infinite elastic isotropic medium through the solution of the coupled temperature and stress equations.

9.34 ARS (American Rocket Society) Journal, March, p. 309-317. Wilson, H.B., "Stresses Owing to Internal Pressure In Solid Propellant Rocket Grains".

9.35 Royal Society (London), July 6, p. 517-542. Philosophical Transactions, Series A. Green, A.E., and England, A.H., "Steady-State Thermoelasticity for Initially Stressed Bodies". Analysis of the problem of an elastic body deformed from a state of zero stress and strain and uniform temperature by a large deformation and steady-state temperature distribution, and subsequently subjected to small displacements and steady-state temperature distributions.

9.36 Experimental Mechanics, August, p. 41-49. Gallagher, R.H., Quinn, J.F., and Turrentine, D., "Techniques for Testing Thermally Affected Complex Structures". Describes equipment and techniques used to determine elastic deflection influence coefficients of stainless steel multispar wing models at elevated temperatures.

9.37 Journal of the American Concrete Institute, Sept., p. 327-340. Zuk, W., "Thermal and Shrinkage Stresses in Composite Beams". Analysis of the thermoelastic deformation of a composite beam based upon the sole restraint condition of equal deformation at the contact surface between the components of the beam.

9.38 Machine Design, November and December (A Four Part Series) Manson, S.S., "A Designer's Guide to Thermal Stresses".

Part I - Basic Suitability of Materials, Nov. 9, p. 186-191.
Part II - Comparative Suitability of Materials, Nov. 10, p. 165-168.
Part III - External Factors in Design, Dec. 7, p. 160-164.
Part IV - Stresses and Strains, Dec. 21, p. 141-146.

Presentation of material, thermal, and geometric factors to be considered in the design of structures subject to thermal stresses.

II.A.9. Miscellaneous Periodical Literature (cont'd)

9.39 Journal of the American Concrete Institute, Dec., p. 773-782.
Gennaro, J.J., "Steady State Thermal Stresses in Rigid Frames". Method for determining the moments and stresses in beams and rigid frames subject to linear variations of temperature between the lower and upper edges of the beam.

1962

9.40 Experimental Mechanics, January, p. 9-14.
Brewer, C.A. and Ingham, J.D.: "Measurement of Thermal Stresses Within An Experimental Nuclear Reactor Vessel Head".

9.41 ARS (American Rocket Society) Journal, February, p. 237-243.
Fried, E. and Costello, F.A.: "Interface Thermal Contact Resistance Problem in Space Vehicles".

9.42 Machine Design, February, p. 185-189.
Forray, M. and Newman, M;: "Stress and Deflection in Heated Plates on Beam Supports". Presents nondimensional curves for calculating maximum thermal stress and deflection in plates supported by either elastic or rigid beams. Effects of nonlinear temperature variations on the system are included.

9.43 Journal of Mechanical Engineering Science, March, p. 12-15.
Cole, B.N. and Coulthard, L.M.F.: "Thermal Stresses in Tubular Heat Exchanger Fins".

9.44 ARS (American Rocket Society) Journal, May, p. 700-707.
Gallagher, R.H., Padlog, J. and Bijlaard, P.: "Stress Analysis of Heated Complex Shapes". Application of the matrix displacement method of complex structure analysis to the determination of stresses in heated, irregularly shaped structural components. Example thermal stress analyses are performed for a rectangular plate, for which extensive test results and results from an alternate theory are available, and for a typical leading edge component. Computational aspects of the problem, including the necessary digital computer program, are discussed.

9.45 Engineering Materials and Design, May, p. 332-335.
Armerod, A.: "Thermal Stresses". Discussion of the generation of thermal stresses, including an evaluation of various factors which lead to these stresses. A method for estimating the thermal stresses is presented.

II.A.9. Miscellaneous Periodical Literature (cont'd)

9.46 ARS (American Rocket Society) Journal, June, p. 934-939.
Hung, F.C.S. and Stone, D.J.: "Thermal Stress Analysis of Reentry Structures with Multiple Corrugated Webs". A simple and approximate method for thermal stress analysis of semi-monocoque wing type reentry structures with multiple corrugated webs is presented. An extended Levy's method is used for calculating the stresses induced by the depth thermal gradients. A matrix force method is briefly discussed for the analysis of the chord bending stresses induced by the presence of chord thermal gradients.

9.47 Experimental Mechanics, June, p. 181-186.
Bell, J.F.: "Experimental Study of Dynamic Plasticity at Elevated Temperatures". Application of the diffraction grating and optical displacement techniques to study plastic wave propagation in solids at elevated temperatures. Strain time, surface angle time, time of contact, coefficient of restitution, displacement time behavior at the free end of the specimen, and stress behavior at the impact face may all be determined. Typical strain time behavior is shown at 800°, 1000°, and 1100°F. for three types of impact situations.

9.48 Journal of the American Concrete Institute, June, p. 815-841.
Fischer, P.: "Differential Temperature Moments in Rigid Frames".

9.49 Machine Design, June 7, p. 175-177.
Forray, M. and Newman, M.: "Buckling of Heated Rectangular Plates". Presents nondimensional curves for the prediction of the onset of thermal buckling in rectangular plates for sinusoidal, parabolic, and "tent" temperature distributions. The graphs can be used for the determination of the plate thickness necessary to prevent buckling of simply supported and clamped plates. A numerical example of their use is included.

9.50 Journal of Mechanical Engineering Science, June, p. 111-120.
Baines, B.H. and Hoyle, R.D.: "Thermal Stresses in Elastic Axially Symmetrical Bodies".

9.51 Quarterly Journal of Mechanics and Applied Mathematics, August p. 339-347.
Holden, J.T.: "Steady-State Thermal Stresses in an Elastic Sphere". Discusses the thermal stress system in an elastic sphere heated by radiation from a distant source. The solution is expressed as a series of zonal harmonics; numerical evaluation of the principal stresses has been carried out. Analysis shows that the stress distribution on the half of the surface exposed to radiation and that on the shaded half are alike.

II.A.9. Miscellaneous Periodical Literature (cont'd)

9.52 The Bell System Technical Journal, September (Vol. XLI), pp. 1519-1536.
Riney, T.D., and Elek, J.W.: "Thermoelastic Stresses in Balanced and Unbalanced Seals". Presents the results of an analytical study of the stresses produced when ceramic cylinders are butt sealed to metal washer plates.

9.53 Machine Design, October 11, p. 203-206.
Newman, M. and Forray, M.: "Thermal Stresses in Circular Bulkheads". Nondimensional design curves for evaluating thermal stresses and deflections in circular plate bulkheads.

9.54 Machine Design, November 8, p. 183-187.
Newman, M. and Forray, M.: "Thermal Stresses in Circular Rings". Design equations and curves for determining thermal stresses and deflections in rings.

9.55 Experimental Mechanics, September, p. 13A.
Brewer, G. and Weymouth, L.J.: "Operating Stresses in Buried Pipeline Found by Weldable Strain Gages". Thermal stresses caused by the flow of compressed natural gas through a pipeline were determined by application of small weldable strain gages.

II.B REPORTS

1. Air Force Office of Scientific Research (AFOSR) U. S. A.

1.1 TN 56-237 May, 1956 (Also NYU College of Engineering TR SM 56-11)
Gerard. G. and Gilbert, A. C.: "Photothermoelasticity: An Exploratory Study". Investigation of optical and physical properties of a photoelastic model material Paraplex P-43 over the temperature range from room temperature to -40°F.

1.2 TN 58-621 July 1958 (Also NYU College of Engineering TR SM 58-5)
Tramposch, H. and Gerard, G.: "Correlation of Theoretical and Photo-Thermoelastic Results on Thermal Stresses in Idealized Wing Structures". Application of the photo-thermoelastic method to the experimental evaluation of thermal stress theories. The new technique was correlated with several theories which analyzed the transient thermal stresses in wing structures of high-speed aircraft.

1.3 TN 59-11 Feb. 1959 (Also, Convair TM 349-2)
Sutherland, R. and White, F.: "Thermal Stresses in a Square Plate with a Central Circular Hole Subjected to an Arbitrary Temperature Gradient". Analysis of the thermal stress problem using the Airy stress function with the assumption of an arbitrary temperature distribution. The results are applied to a plate subjected to a simple doubly-symmetrical temperature distribution.

1.4 TR 59-203 Dec. 1959
Singer, J., and Hoff, N. J.: "Buckling of Conical Shells Under External Pressure and Thermal Stresses". Simplified differential equations governing the deformations of deep thin circular conical shells subjected to arbitrary loads and arbitrary temperature distributions are derived by the principle of minimum total potential energy. The equations reduce to Donnell's equations (extended to include an arbitrary temperature distribution) when the cone angle approaches zero. An asymptotic solution of these simplified equations is then obtained for a truncated conical shell subjected to an axisymmetrical temperature distribution.

1.5 TN 59-301 March 1959 (Duke U.)
Sneddon, I.N., and Lockett, F.J.: "On the Steady State Thermoelastic Problem for the Half-Space and the Thick Plate". Treats the problem of steady-state thermal stress in semi-infinite elastic body and an elastic solid bounded by two parallel planes. All surfaces are free from traction but are under arbitrarily prescribed temperatures. Double Fourier transforms are employed to obtain solutions in terms of two-dimensional Fourier integrals.

II.B.1. (AFOSR) (Cont'd)

1.6 TN 59-327 May 1957 (Also, Columbia U. Dept. of Civil Eng. and Eng. Mech., Inst. of Flight Structures, TN2).
Herrmann, G.: "Energy Methods for the Analysis of Temperature Distributions and Thermal Stresses in Structures". Energy theorems of structural analysis in a generalized form for the case when a part of the stresses is due to thermal effects. The three energy methods discussed represent extensions of Green's principle for displacements, Castigliano's principle for stresses, and Reissner's generalized principle for displacements and stresses.

1.7 TN 59-498 April 1959 (Duke U.)
Lockett, F. J.: "Propagation of Thermal Stresses in a Semi-Infinite Medium".

1.8 TN 59-1014 June, 1959 (Also, Roma U. Sch. Aero. Eng. Inst. Aero. Construc. Rep. SIAR 53).
Broglio, L.: "Transient Temperatures and Thermal Vibrations in Space Structures". Solution of the heat conduction problem and of the static and dynamic thermal stresses by solving two different eigen problems: The problem of the natural frequencies and normal modes of vibration of an ideal body whose elasticity and mass are related to the thermal coefficients of the body, and the problem of the actual frequencies and modes of vibration of the real body. The general solution of each of the two problems is reached when Green's function is determined.

1.9 TN 59-1015 Feb. 1959 (Also, Roma U., School of Aero. Eng. Inst. Aero. Const. Report SIAR 52)
Broglio, L.: "Anisotropic Composite Thermal Structures for Hypersonic Flight". Fundamental solutions for the temperature distribution and thermoelastic motion produced by an instantaneous heat source located at an arbitrary point in an anisotropic heterogeneous composite body of arbitrary shape. Application of the results is made to composite and anisotropic structures.

1.10 TN 59-1250 Dec. 1959 (Also, Stanford Univ. Report SUDAER 88).
Hill, D. W.: "Buckling of a Thin Circular Cylindrical Shell Heated Along an Axial Strip".

1.11 TN 59-1274 Jan. 1960 (Also Convair Report TM-349-14).
Sutherland, R. D. and Shook, R. G.: "Thermo-Elastic Equations Applicable to Thick-Wall Pointed Shells of Revolution".

1.12 TR 60-140 July, 1960
Parkus, H.: "Elastic Thermal Stresses in Delta Wings - I". The basic equations of shallow shells of arbitrary shape in orthogonal coordinates

II.B.1. (AFOSR) (Cont'd)

1.12 (Cont'd)

are generalized to include thermal stresses; use is made of tensor notation, so that the results are not restricted to orthogonal coordinates. The boundary conditions for symmetric temperature distributions are formulated; a perturbation method for the basic equations is developed, and a solution for the first approximation is obtained. Numerical results are obtained for a set of isosceles triangles with vertex angle varying from 30° to 120°, and the equipotential lines and streamlines corresponding to concentric circles and radial lines in the unit-circle plane are plotted.

1.13 TN 60-320 Feb. 1960 (Also, Stanford Univ. Report SUDAER 90). Parkes, E. W.: "Heat Conduction and Thermal Stresses in a Solid Having Unequal Specific Heats".

1.14 TN 60-321 Jan. 1960 (Also, Stanford Univ. Report SUDAER 89). Parkes, E. W.: "The Stresses in an Elasto-Plastic Bar Subjected to a Sudden Change of Surface Temperature".

1.15 TN 60-380 Feb. 1960 (Also, Stanford Univ. Report SUDAER 91). Parkes, E. W.: "Thermoelasticity".

1.16 TN 60-418 Apr. 1960 (Also, Columbia Univ. Report CU-10-60-AF-430-CE). Hermann, G.: "On Variational Principles in Thermo-Elasticity and Heat Conduction".

1.17 TN 60-504 May, 1960 (Also, Polytechnic Inst. of Bklyn, PIBAL Report 557). Pohle, F. V., Lardner, T. J., and French, W.: "Temperature Distribution and Thermal Stresses in Structures with Contact Resistance". Investigation of the temperature distribution in a built-up structure composed of cover plates and a web and with contact resistance at the junction of the cover plates and web. Graphs of temperatures and stresses are presented for the case of constant flux of heat to the cover plates.

1.18 TN 60-840 June, 1960 (Also, Convair Report TM 349-19). Sutherland, R. D. and Manville, S. M.: "Thermal Stresses in a Perforated Square Plate". Solution for thermal stresses in a square plate containing a central circular hole by use of the complex variable technique.

1.19 TN 60-1046
Sneddon, I. N.: "A Class of Solutions of the Equations of Thermoelastic Equilibrium."

1.20 TN 60-1166 May, 1961 (Also, Penn. State Univ., Dept Engng. Mech. TR 1) Jaunzemis, W.: "Transient Thermal Stresses in a Thin Disk".

II.B.1. (AFOSR) (Cont'd)

1.21 TN 60-1167 May, 1961 (Also, Penn. State Univ., Dept. Engng. Mech. TR 2). Vavouras, G. J., and Jaunzemis, W.: "Thermal Stresses Produced in a Disk by a Rotating Heat Source".

1.22 TN 61-646 Jan. 1961 (Also, Stanford U. Report SUDAER 99). Hoff, N. J.: "The Effects of Temperature and Time on Aircraft and Missile Structures". Survey of problems introduced into the structural analysis of airplanes and missiles by the high temperatures resulting from aerodynamic heating. Thermal stresses, thermal buckling, the effect of creep on stress distribution and stability, and ablation are discussed.

1.23 TN 61-770 Apr. 1961 (Also, Stanford U., Dept. Aero. Eng., Report SUDAER 103). Hemp, W. S.: "Deformation of Heated Shells". Analysis of the deformation and stresses for large heat-induced deformations of thin shells. The properties of the middle surface, before and after deformation, are defined by tensors which satisfy the Gauss and Codazzi equations of surfaces. The state of strain is then defined in terms of these quantities, and compatibility equations for membrane strains and curvature changes.

1.24 TN 61-989 June, 1961 (Also, Stanford U. Report SUDAER 106). Queninec, A.: "Thermal Buckling Centrally Heated Circular Plates". Experimental and theoretical investigation of the behavior of a centrally heated flat circular plate with axisymmetric temperature distribution and free-edge conditions. The buckling and postbuckling behavior of the plate are studied, and analytical solutions are obtained. Attempts are made to introduce the effect of initial irregularities in the plate and to solve the large-deflection problem.

1.25 Report 1050 June, 1961 (Also, Convair TM 349-35). Sutherland, R., Manville, S., Schneider, K., Shook, R., and White, F.: "Thermal Stresses in Perforated Plates and Bodies of Revolution". Extension of previous analyses of the thermal stresses in perforated plates and bodies of revolution, to cover (1) a square plate with a central circular perforation, (2) a circular plate with a central star-shaped perforation, and (3) exact solutions for ogival bodies of revolution. Closed-form solution for the thermal stresses in bodies of revolution is obtained by restriction of the problem to the aft end of the ogive-shaped body considered.

1.26 Report 1510 Aug. 1961 Buckens, F.: "Thermoelastic Stability, Stresses and Deflections of Thin Plates". Approximate solution to the problem of the stability of a homogeneous, simply-connected thin plate for arbitrary thermal stress

II.B.1. (AFOSR) (Cont'd)

1.26 (Cont'd)

distributions, under the assumption that the edges are unrestrained in the plane. Under special conditions, the solution is shown to give a lower bound for the critical temperature level, provided that the relative distribution does not change with increasing temperature.

1.27 Report 1237 Aug. 1961 (Also, John Hopkins U. Dept. Mech. TN 1). Dillion, O. W., Jr.: "A Nonlinear Thermoelasticity Theory". Analysis of the temperature generated by the deviatoric components of strain. After a general formulation of this effect, a specific case of the torsional oscillations of a round bar is considered. The solution of this problem indicates that appreciable temperature can be generated at strains which would be considered small in the field of plasticity.

1.28 Report 2280 (Also, Poly. Inst. Brooklyn, Dept. Aerospace Engng. Appl. Mech. Report 599). Feb. 1962. Kempner, J., "Investigation of Plates and Shells under External Loading and Elevated Temperatures".

2. Advisory Group for Aeronautical Research and Development, NATO (AGARD).

2.1 Report No. 2 June, 1956
Hoff, N. J.: "Thermal Problems in Aircraft Structures". Survey Paper.

2.2 Report No. 3 Sept. 1955
Duberg. J.: "Aircraft Structures Research at Elevated Temperatures". Review of the test techniques developed and used by the NACA for experimental research and presentation of some experimental results.

2.3 Report No. 60 Aug. 1956
Van Der Neut, A.: "Post Buckling Behavior of Structures". Solutions for flat plate at constant temperature and for thermal loading are discussed and compared to available experimental evidence.

2.4 Report No. 90 Aug. 1956
Bollenrath, F.: "Some Remarks Upon the Problem of Temperature Shock in Aircraft". (Also published in German as DVL Report No. 30). Discussion of structural problems associated with heating and large temperature gradients. The thermal stresses due to a nonstationary distribution of temperature are calculated for a gas moving at high speed.

2.5 Report No. 205 Oct. 1958
Heldenfels, R. R.: "High Temperature Testing of Aircraft". Some of the

II.B.2. (AGARD) (Cont'd)

2.5 (Cont'd)

newer equipment and techniques used for high-temperature testing of aircraft structures and structural materials are described, representative research projects are discussed and typical results are presented.

2.6 Report No. 206 Oct. 1958
Taylor, J.: "General Introduction to Thermal Structures". The basic aerodynamics and materials data for the study of thermal structures are surveyed, and the basic structural theory that has been developed is reviewed. A special discussion is included on the combination of strains due to temperature and strains due to load.

2.7 Report No. 207 Oct. 1958
Rubesin, M.: "The Influence of Aerodynamic Heating on the Structural Design of Aircraft".

2.8 Report No. 208 Oct. 1958
Thomann, G. E. A. and Erb, R. B.: "Some Effects of Internal Heat Sources on the Design of Flight Structures". Survey on the problems which arise due to heating of a structure. The magnitude and accuracy of the heat sources and their effects on the structure are discussed, followed by a more complete assessment of the engine-bay problem, its heating, structural effects, and design considerations.

2.9 Report No. 213 Oct. 1958
Parkes, E. W.: "A Design Philosophy for Repeated Thermal Loading". Theoretical study discussing the elastic and inelastic behavior of some simple structures subjected to cyclic thermal loading. The results obtained are considered in relation to possible definitions of structural safety.

2.10 Report No. 215 Oct. 1958
Heath, B. O.: "Structural Design for High Temperature".

2.11 Report No. 216 Oct. 1958
Ashley, H. R.: "Sandwich Structure for High Temperature Vehicles". A review of the high temperature sandwich structure from the viewpoints of theoretical structural efficiency and of practical design and manufacturing. Thermal stress factors for materials at various temperatures are also presented.

2.12 Report No. 312 Oct. 1960
Huston, W. B.: "Surface Warp and Aerodynamic Heating". The state of the art of relating temperatures, structural deformation, and aerodynamic

II.B.2. (AGARD) (Cont'd)

2.12 (Cont'd)

loads is reviewed briefly. Some representative structural problems and the interrelation between structural deformation and acrodynamic load are considered.

3. Aeronautical Research Council (Great Britian)

3.1 Current Report No. 299, 1956
Heaps, N. S.: "Transient Thermal Stress in a Flat Plate Due to Nonuniform Heat Transfer Aeross One Surface". Analysis in whieh a heat transfer coefficient is postulated on an exposed surfaee. The eoeffieient varies inversely as the square of the distanee from one of the longitudinal edges, and a state of no heat transfer is postulated for the edges of the plate. The solution in terms of Bessel functions is used to estimate transient thermal stresses indueed in an aircraft wing when suddenly acquiring high supersonic veloeity.

3.2 R. and M. 3034, 1957
Argyris, J. H., and Kelsey, S.: "The Matrix Force Method of Structural Analysis and Some New Applications". The basic principles of the matrix foree method of struetural analysis are summarized. The analysis is developed in general terms and is applicable to any structure eomposed of an assemblage of arbitrary elastic elements.

3.3 R. and M. 3115, 1959
Mansfield, E. H.: "The Influenee of Aerodynamie Heating on the Flexural Rigidity of a Thin Wing". Derives the differential equation for the ehordwise deflection of a long solid wing with chordwise thiekness variation and ehordwise variation of middle-surfaee stresses, bent into the form of a "near cylinder" of radius R, by a variational method.

3.4 R. and M. 3245, 1962
Cotterell, B. and Parkes, E. W.: "Thermal Buekling of Circular Plates". The post-buckling of a eireular plate is investigated for heating over the eenter and heating at the edge. The plate may be free or it may be subjected to a variety of edge restraints. General nondimensional eurves are presented for the defleeted form and bending stresses.

3.5 R. and M. 3267, 1961
Mansfield, E. H.: "The Effect of Temperature Variations in the Plane and Through the Thiekness of a Circular Lenticular Plate".

II,B,4. Aeronautical Research Laboratory (Australia)

4.1 Report S.M. 261 June 1958
Kleeman, P. W.: "Survey of Thermal Problems as Affecting the Structure of High Speed Aircraft.

4.2 Report Me. 89 Nov. 1958
Johnson, C.H. J.: "Transient Thermal Stresses in an Elastic Half-Space". Derivation of expressions for the transient thermal stress distribution within an elastic half-space. Three cases of temperature boundary conditions are considered: (a) uniform constant temperature on a boundary plane; (b) uniform constant heat flux on the boundary plane; and (c) radiation to the boundary plane from a medium at constant temperature.

4.3 Mech. Eng. Note 232 Mar. 1959
Johnson, C. H. J.: "Transient Thermal Stresses in the Elastic Slab". Solution to the problem of determining the transient thermal stress distribution in an infinite elastic slab due to the sudden simultaneous application of a temperature T_1 to one face and a temperature T_2 to the other face, the initial conditions being zero and with zero surface tractions. The solution is presented in series form whose successive terms give the stress at a particular depth in a semi-infinite solid with a constant temperature boundary condition.

4.4 Report SM 269 Sept. 1959
Kleeman, P. W.: "Creep in Aircraft Structures". Discusses the creep buckling of columns, plates and shells; the redistribution of stress under creep conditions; the estimation of total structural deformation, together with the more basic topics of stress-strain relations, methods of analysis, and material data, on which the above aspects depend.

5. National Aeronautics and Space Agency (NASA)
(National Advisory Committee for Aeronautics (NACA) prior to October 1958)

Technical Notes

5.1 TN 3474 Sept. 1955
Kotanchik, J. N., Johnson, A. E., Jr., and Doss, R. D.: "Rapid Radiant-Heating Tests of Multiweb Beams". Four multiweb box beams were subjected to radiant heating in the absence of applied loads. Measured temperatures in the covers and webs are given. Measured strains in the webs were used to determine bending distortions and stresses. Stresses at buckling were found to agree with those predicted by an elementary thermal-stress analysis.

II.B.5. National Aeronautics and Space Agency (NASA)
(National Advisory Committee for Aeronautics (NACA) prior to October 1958) (Cont'd)

Technical Notes (Cont'd.)

5.2 TN 3699 June 1956
Griffith, G. E. and Miltonberger, G. H.: "Some Effects of Joint Conductivity on the Temperatures and Thermal Stresses in Aerodynamically Heated Skin-Stiffener Combinations." Temperatures and thermal stresses in aerodynamically heated skin-stiffener combinations were calculated with the aid of an electronic differential analyzer. Variations were made in an aerodynamic heat-transfer parameter, a joint conductivity parameter, and the ratio of skin width to skin thickness.

5.3 TN 3778 Nov. 1956
Mendelson, A. and Hirschberg, M.: "Analysis of Elastic Thermal Stresses in Thin Plate with Spanwise and Chordwise Variations of Temperature and Thickness". Method for computing thermal stresses in thin plates of variable thickness with the effect of the free-end automatically included. The method uses polynomial approximations for the stress function in order to reduce the partial differential equation to a set of ordinary equations. This results in satisfying the differential equation everywhere spanwise and at a finite number of stations chordwise. The boundary conditions are everywhere satisfied.

5.4 TN 4051 June 1957
Pride, R. A., Hall, J., and Anderson, M.: "Effects of Rapid Heating on Strength of Airframe Components." Experimental investigation to determine the influence of aerothermodynamic stresses on the bending strength of multiweb beams and ring-stiffened cylinders.

5.5 TN 4052 June 1957
Brooks, W., Griffith, G. and Strass, H.: "Two Factors Influencing Temperature Distributions and Thermal Stresses in Structures". Discussion of the effects of joint conductivity and internal radiation on a simple integral structure and one with attached webs.

5.6 TN 4053 June 1957
Zender, G. W. and Pride, R. A.: "The Combination of Thermal and Load Stresses for the Onset of Permanent Buckling in Plates". Method for evaluating the onset of permanent buckling in plates in the presence of combined thermal and compressive load stresses. A particular application of the method shows reasonable agreement with tests of 17-7 PH stainless steel square tubes.

II.B.5. National Aeronautics and Space Agency (NASA)
(National Advisory Committee for Aeronautics (NACA) prior to October 1958) (Cont'd)

Technical Notes (Cont'd.)

5.7 TN 4054 June 1957
Vosteen, L., McWithey, R. and Thomson, R. G.: "Effect of Transient Heating on Vibration Frequencies of Some Simple Wing Structures". Investigation of some of the effects caused by nonuniform temperature distributions in the effective stiffness of wing structures. Tests are conducted on a uniform plate, solid double-wedge section, and circular-arc multiweb wing section.

5.8 TN 4115 Sept. 1957
O'Sullivan, W. J.: "Theory of Aircraft Structural Models Subject to Aerodynamic Heating and External Loads". Dimensional analysis of the problem of investigating the simultaneous effects of transient aerodynamic heating and external loads on aircraft structures. Results indicate that a structural model can be built which has the required similitude with respect to flow of heat through it, thermal stresses and deformations. and stresses and deformations due to external loads.

5.9 TN 4205 Mar. 1958
Pride, R. A. and Hall, J. B.: "Transient Heating Effects on the Bending Strength of Integral Aluminum-Alloy Box Beams". Determination of the interaction effects of external loading and rapid nonuniform and uniform heating on both buckling and the compressive failure of box beams. Equations for buckling and maximum bending strength are derived. and the calculated results are compared with the experimental data.

5.10 TN 4306 Aug. 1958
Brooks, W. A.: "Temperature and Thermal-Stress Distributions in Some Structural Elements Heated at a Constant Rate: Analytical solutions are given for the temperature and thermal-stress distributions in thick skins and structural elements such as angle, channel, T-, and H-sections when heated at a constant rate. Some are evaluated for selected cross-sectional proportions and results are presented in the form of charts involving dimensionless temperature, stress, and time parameters.

5.11 TN 4349 Sept. 1958
Swann, R. T.: "Heat Transfer and Thermal Stresses in Sandwich Panels". Calculated maximum temperature differences between faces and calculated thermal stresses are presented for sandwich panels with a

II.B.5. National Aeronautics and Spaee Agency (NASA)
(National Advisory Committee for Aeronauties (NACA) prior to October 1958) (Cont'd)

Technieal Notes (Cont'd.)

5.11 (Cont'd)

prescribed linear heating rate at one face and with the other face insulated. Effects of conduction and radiation are included.

5.12 TN D-38 Sept. 1959
Thomson, R. G. and Sanders, J. L.: "Effect of Chordwise Heat Conduction on the Torsional Stiffness of a Diamond-Shaped Wing Subjected to a Constant Heat Input". Analysis of the reduction in torsional stiffness of a wing due to a suddenly applied constant heat input, considering chordwise heat conduction. Analytic solutions are obtained by using separation of variables and Mellin transforms, and the computed results are given in graphical form.

5.13 TN D-104 Oct. 1959
McWithey, R. R.: "Minimum-Weight Analysis of Symmetrical-Multiweb-Beam Structures Subjected to Thermal Stress". A minimum-weight analysis based upon buckling and yielding stresses is presented for multiweb beams subjected to thermal stress. Curves of minimum structural weight and optimum value of the beam parameters are shown as a function of bending moment for various temperature differences between skin and web.

5.14 TN D-271 April 1960
Johnson, D. F.: "Analysis of Elastic-Plastic Stress Distribution in Thin-Wall Cylinders and Spheres Subjected to Internal Pressure and Nuclear Radiation Heating." Application of a finite-differences method combined with a technique of successive approximations to calculate the stresses in shells subjected to internal pressure, symmetrical nuclear heating, and inside-wall cooling.

5.15 TN D-362 May 1960
McWithey, R. R., and Vosteen, L. F.: "Effects of Transient Heating on the Vibration Frequencies of a Prototype of the X-15 Wing." A prototype of the X-15 wing under simulated aerodynamic heating conditions. Results of a test indicate no large changes in effective stiffness as a result of the heating conditions.

5.16 TN D-384 May 1960
Zender, G. W. and Hall, J.: "Combinations of Shear, Compressive Thermal, and Compressive Load Stresses for the Onset of Permanent

II.B.5. National Aeronautics and Space Agency (NASA) (National Advisory Committee for Aeronautics (NACA) prior to October 1958) (Cont'd)

Technical Notes (Cont'd.)

5.16 (Cont'd)

Buckles in Plates". Semi-empirical method of evaluating the onset of permanent buckles in plates. Results of the method are compared with experimental values for the onset of permanent buckles obtained from tests of square tubes of 17-7 PH stainless steel.

5.17 TN D-460 June 1960
Runyan, H. L. and Jones, N. H.: "Effect of Aerodynamic Heating on the Flutter of a Rectangular Wing at a Mach Number of 2".

5.18 TN D-520 Jan. 1961
Davidson, J. R. and Dalby, J. F.: "Optimum Design of Insulated Compression Plates Subjected to Aerodynamic Heating".

5.19 TN D-848 June 1961
Johnston, J. R., Freche, J. C., and Signorelli, R. A.: "Transient Temperature Profiles and Calculated Thermal Strains of Turbojet-Engine Buckets". Tests were conducted to measure the chordwise temperature profiles in the buckets of two turbojet engines (J47 and J33) subjected to starts, accelerations, decelerations, and shutdowns. The temperature measurements were used in conjunction with analytical procedures based on elastic strain concepts and simple beam theory to calculate thermal strains in the bucket airfoils.

5.20 TN D-921 Oct. 1961
Dixon, S. C.; Griffith, G. E. and Bohon, H. L.: "Experimental Investigation at Mach Number 3.0 of the Effects of Thermal Stress and Buckling on the Flutter of Four-Bay Aluminum Alloy Panels with Length-Width Ratios of 10".

5.21 TN D-1182 March 1962
Roberts, E., Jr.: "Elastic Design Charts for Thin Plates with Spanwise and Chordwise Variations in Temperature". Presents graphs and tables for the rapid determination of the elastic state of stress at any point in a thin, flat, rectangular plate of uniform thickness loaded by both spanwise and chordwise thermal gradients. In addition, all relations from which the graphs and tables are developed, and the derivation of these expressions are given. Examples illustrating use of the graphs and tables are presented.

II.B.5. National Aeronautics and Space Agency (NASA)
(National Advisory Committee for Aeronautics (NACA) prior to October 1958) (Cont'd)

Technical Notes (Cont'd.)

5.22 TN D-1224 April 1962
Anderson, M. S.: "Combinations of Temperature and Axial Compression Required for Buckling of a Ring-Stiffened Cylinder". Presentation of a theory for predicting the buckling temperature of an axially compressed, uniformly heated ring-stiffened cylinder. The cylinder buckles because of the interaction of the axial stress due to applied compressive loads and the circumferential stress resulting from restraint of thermal expansion by the rings. Buckling charts covering a wide range of cylinder proportions are presented for both clamped and simply supported cylinders.

Reports

5.23 Report 1361 Aug. 1957 (Formerly TN 4067)
Heldenfels, R. R. and Vosteen, L.: "Approximate Analysis of Effects of Large Deflections and Initial Twist on Torsional Stiffness of a Cantilever Plate Subjected to Thermal Stresses". Presents an approximate analysis of the nonlinear effects of initial twist and large deflections on the torsional stiffness of a cantilever plate subjected to a nonuniform temperature distribution. The von Karman large-deflection equations are satisfied through the use of a variational principle. Results calculated by this analysis are in satisfactory agreement with measured torsional deformations and changes in natural frequency.

Reports and Memoranda

5.24 RM L55B03 Mar. 1955
Pride, R.: "An Investigation of the Effects of Rapid Heating on Box Beams Loaded in Bending".

5.25 RM L55F13 Aug. 1955
Griffith, G. E., Miltonberger, G. and Rosecrans, R.: "Tests of Aerodynamically Heated Multiweb Wing Structures in a Free Jet at Mach 2."

5.26 RM L56D06
Heldenfels, R. and Mathauser, E.: "A Summary of NACA Research on the Strength and Creep of Aircraft Structures at Elevated Temperatures".

II.B.5. National Aeronautics and Space Agency (NASA) (National Advisory Committee for Aeronautics (NACA) prior to October 1958) (Cont'd)

Reports and Memoranda (Cont'd.)

5.27 RM L57H19 Oct. 1957
Miltonberger, G., Griffith, G., and Davidson, J.: "Tests of Aerodynamically Heated Multiweb Wing Structures in a Free Jet at Mach 2. Two Aluminum Alloy Models of 20 Inch Chord".

5.28 RM L58C24 June 1958
Griffith, G. and Miltonberger, G.: "Tests of Aerodynamically Heated Multiweb Wing Structures in a Free Jet at Mach 2. An Aluminum Alloy Model of 40 Inch Chord with 0.125 In. Skin".

5.29 Memo 10-12-58L Oct. 1958
Davidson, J. and Rosecrans, R.: "Tests of Aerodynamically Heated Multiweb Wing Structures in a Free Jet at Mach 2. Three Models of 20-Inch Chord and Span".

5.30 Memo 1-30-59L Feb. 1959
Thomson, R.: "Effects of Cross-Sectional Shape, Solidity, and Distribution of Heat Transfer Coefficient on the Torsional Stiffness of Thin Wings Subjected to Aerodynamic Heating".

5.31 Memo 6-4-59W June 1959
Kroll, W. D.: "Aerodynamic Heating and Fatigue". Presents a review of future physical operating conditions for aircraft with special emphasis on elevated temperature fatigue.

5.32 Memo 6-14-59L June 1959
Mathauser, E. E. and Berkovits, A.: "Determination of Static Strength and Creep Buckling of Unstiffened Circular Cylinders Subjected to Bending at Elevated Temperatures". A semi-empirical procedure is presented for predicting static strength and creep buckling of unstiffened circular cylinders subjected to pure bending at elevated temperatures. The method is applicable to cylinders that are loaded into the inelastic stress range prior to buckling and fail in a local mode.

5.33 TM X-33 Sept. 1959
Groen, J. and Johnson, A. E.: "Elevated-Temperature Tests Under Static and Aerodynamic Conditions on Honeycomb-Core Sandwich Panels".

II.B.5. National Aeronautics and Space Agency (NASA)
(National Advisory Committee for Aeronautics (NACA) prior to October 1958) (Cont'd)

Reports and Memoranda (Cont'd.)

5.34 TM X-34 Sept. 1959
Groen, J. and Johnson, A. E.: "Elevated-Temperature Tests Under Static and Aerodynamic Conditions on Corrugated-Stiffened Panels".

5.35 TM X-186 Jan. 1960
Trussell, D. and Johnson, R.: "Tests of Aerodynamically Heated Multiweb Wing Structures in a Free Jet at Mach Number 2: Five Aluminum-Alloy Models of 20-Inch Chord with 0.064-Inch-Thick Skin, 0.025-Inch-Thick Webs, and Various Chordwise Stiffening at 2° Angle of Attack".

5.36 TM X-314 Sept. 1960
Pride, R. A., Royster, D. and Helms, B.: "Experimental Study of a Hot Structure for a Re-Entry Vehicle".

6. National Bureau of Standards (U.S.A.)

6.1 Report 5927 June 1958
Goodman, S., Russell, S. B., and Noble, C. E.: "Effect of Variation of Emissivity of Internal Surfaces of Heated Box Beams on Temperature Distribution, Thermal Stress and Deflection". Transient temperature distribution histories, thermal stresses, and deflections for 13 box beams uniformly heated along one cover are presented. Various heating rates, geometries of beam cross section, and thermal properties are considered. Heat transfer was by radiation and conduction. Gaseous heat transfer and possible effects of yielding, creep, and buckling were neglected.

6.2 Journal of Research, April 1959, p. 175-181
Goodman, S., Russell, S. B. and Noble, C. E.: "Effect of Internal Radiant Heat Transfer on Temperature Distribution, Thermal Stress, and Deflection in Box Beams". Computer analysis of 13 box beams with thermal and elastic properties linearly dependent of the temperature. Different combinations of wall thickness, heating rate and interior and exterior emittances are considered.

6.3 Monograph 2, June 1960
Adams, L. H. and Waxler, R. M.: "Temperature-Induced Stresses in Solids of Elementary Shape". Equations are presented in convenient form for calculating the stresses in solids of certain shapes when subjected (a) to a sudden change of surface temperature, or (b) to a

II.B.6. National Bureau of Standards (U.S.A.) (Cont'd)

6.3 (Cont'd)

temperature that increases or decreases linearly. It is assumed that there is no creep or yielding in the material. Tables of certain temperature functions are offered as a means of quickly determining stresses in a slab, cylinder, or sphere subjected to the two types of heating.

7. National Research Council (Canada)

7.1 National Aeronautical Estab., Structures Lab.,
Aero. Rep. LR-257, July 1959
Grzedzielski, A. L. M.: "Organization of a Large Computation in Aircraft Stress Analysis". Theoretical and organizational aspects of a large-scale numerical stress analysis covering effects of applied loads and uneven temperature are discussed, using the example of a swept multispar model box for which experimental data are available.

7.2 Mechanical Engineering Report MS-101 March 1960
Cowper, G.: "Thermal Stresses Due to an Arbitrary Heat Source in a Circular Cut-Out".

7.3 National Aeronautical Estab., Structures Lab,
Aero. Rep. LR-297 January 1961.
Grzedzielski, A. L. M.: "Theory of Multi-Spar and Multi-Rib Wing Structures". A matrix force technique for the analysis of built-up low aspect ratio wings is described. Matrix methods of thermal-stress analysis are also developed, and a theory of thermal effects and local plastic action is proposed.

7.4 National Aeronautical Estab., Structures Lab.,
Aero. Rep. LR-300 February 1961.
Cowper, G.: "Thermal Stresses in Multi-Layer Spherical Shells". Analysis of the thermal stresses that may occur in the aerodynamic heating of an insulated aircraft structure as a result of a steady temperature. gradient across the skin and internal pressure. A method of stress calculation is outlined, and numerical results are obtained for thin spherical aluminum shells, covered with layers of different insulating materials, bonded together.

8. Royal Aircraft Establishment (Farnborough, England)

8.1 TN Aero. 2397, Sept. 1955
Hartshorn, A. S.: "The Temperature of Materials at High Flight Speeds and the Problems Involved".

8.2 TN Struct. 177 Oct. 1955
Horton, W. H.: "A Preliminary Study of the Effects of Kinetic Heating on the Design and Testing of Aircraft Structures".

8.3 Rep. Struc. 229 Sept. 1957
Mansfield, E. H.: "The Influence of Aerodynamic Heating on the Flexural Rigidity of a Thin Wing". Analysis considering flexural behavior of a thin solid wing of infinite aspect ratio with a given chordwise distribution of spanwise middle surface stresses. The strain energy in the middle surface of the wing is determined. Variational methods are used for the chordwise variation of the distortion of the wing.

8.4 Rep. Struc. 237 Mar. 1958
Mansfield, E. H.: "Combined Flexure and Torsion of a Class of Thin Heated Wings: A Large Deflection Analysis". Calculation of stresses for solid or hollow wings of biconvex section with a parabolic chordwise temperature distribution. The analysis embraces the buckled, as well as the unbuckled, regimes. Formulas and graphs are presented which enable the distortion of a wing under given moments, torques, and thermal stresses to be determined.

8.5 Rep. Struc. 250 May 1959
Mansfield, E. H.: "Leading Edge Buckling Due to Aerodynamic Heating". Analysis of leading edge buckling in wings that may be regarded structurally as plates of variable rigidity. An inverse method of solution is used in which a "critical buckling stress distribution" appropriate to a given wing section is studied.

8.6 Rep. Struct. 254 May 1960
Pope, G. G.: "Thermal Stresses Near the Roots of Rectangular Wings"

8.7 Rep. Struct. 259 Feb. 1961
McKenzie, K.: "The Leading Edge Buckling of a Thin Built-Up Wing Due to Aerodynamic Heating". Analysis of the leading-edge buckling of a thin built-up wing subjected to spanwise thermal stress. The effect of chordwise ribs on the buckling load is estimated by calculating the variation of buckling stress with wavelength in some particular examples. Computed values of the buckling load are presented in graphical form for a wide variation of leading edge dimensions, and the results are used to obtain buckling criteria for some specific examples.

9. Wright Air Development Center (WADC)
(U.S. Air Force Research and Development Command)

9.1 TR 54-384 1955
Schmit, L. A., and Williams, F. L.: "The Effects of Thermal Radiation on Aircraft Structures".

9.2 TR 54-499 Oct. 1954
Allen, H., Brull, M. A. and Wilkie, W.: "A Study of the Stress-Analysis and Structural-Testing Procedures Applicable to Aircraft Structures at Elevated Temperatures". Includes applications of the theory of time-dependent elasticity and the design of a thermal-stress simulator oven container and loading system.

9.3 TR 54-579 1955
Ambrosio, A. and Ishimoto, T.: "Analytical Studies of Aircraft Structures Exposed to Transient External Heating".

9.4 TR 55-99 1955
Brahtz, J. F., and Dean, A.: "An Account of Research Information Pertaining to Aerodynamic Heating and Airframe". Includes a five-volume Part II on Bibliography. Much of the thermal stress literature in English pertaining to methods of analysis is listed in Volume 4.

9.5 TN 55-149 Sept. 1955
Baird, R. B.: "Equipment and Heating Methods for Structural Testing Aircraft at Elevated Temperatures".

9.6 TN 55-176 Nov. 1955 (Classified Confidential)
Gray, E. I., and Gartland, R. H.: "Theoretical and Experimental Methods of Thermal Stress Analysis as Applied to Aircraft Structural Components".

9.7 TR 55-291 1956
Hoff, N. J., Et Al: "Theory and Experiment in the Solution of Structural Problems of Supersonic Aircraft".

9.8 TR 55-305 1956
Dukes, W. H., Schnitt, A.: "Structural Design for Aerodynamic Heating". Part I Design Information, Part II Analytical Studies, Part III Structural Design.

9.9 TN 55-330 July 1956
Pohle, F. V., and Berman, I.: "Thermal Stresses in Airplane Wings Under Constant Heat Input". Theoretical investigation to extend previous analyses for nonconstant boundary-layer temperature to the treatment of a range of geometrical parameters in order to provide results, in the form

II.B.9. Wright Air Development Center (Cont'd)

9.9 (Cont'd)

of graphs for a specific model for which test data are available, that will be practical for design work.

9.10 TR 55-350 Sept. 1956
Sprague, G. H., and Huang, P. C.: "Analytical and Experimental Investigation of Stress Distributions in Long Flat Plates Subjected to Longitudinal Loads and Transverse Temperature Gradients." Presentation of methods for calculating stress distribution under various load-temperature conditions.

9.11 TN 55-512 June 1955
Weiner, J. H.: "An Elasto-Plastic Thermal Stress Analysis of a Free Plate".

9.12 TN 56-40 1956
Kempner, J., and Hoff, N. J.: "Bibliography of Creep for Structural Engineers".

9.13 TR 56-145 August 1956
Hoff, N. J., Et Al: "Induction Heating and Theory in the Solution of Transient Problems of Aircraft Structures".

9.14 TR 56-149 July 1956
Loria, J. C., and Schmit, L. A.: "The Temperature Response of Thick Plates Exposed to Radiant Heat Pulses".

9.15 TR 56-227 June 1956
Allen, H. F.: "An Experimental Study Relating to the Prediction of Elevated Temperature Structural Behavior from the Results of Tests at Room Temperature".

9.16 TN 56-270 May 1956
Pohle, F. V. and Berman, I.: "Thermal Buckling".

9.17 TN 56-380 1956
Gatewood, B. E.: "Allowable Stresses in Aircraft and Missile Structures at Elevated Temperatures".

9.18 TR 56-544 February 1957 SECRET
Loria, J. C.: "A Correlation Study of the Thermo-Elastic Response of a Box-Beam Exposed to Thermal Radiation".

II.B.9. Wright Air Development Center (Cont'd)

9.19 TR 57-69 April 1957
Singer, J.; Anliker, M., and Lederman, S.: "Thermal Stresses and Thermal Buckling". Derivation, discussion, and generalization to include the variable-thickness case, of methods available for analyzing thermal stresses in flat plates having rectangular planform and constant or variable thickness.

9.20 TR 57-184 September 1957
Gray, E. I.; Frank, I., and Atamian, L. J.: "Thermoelastic Studies on Heated Aircraft Sections with Correlation of Experimental Data".

9.21 TR 57-372 June 1958
Lieb, B. A.: "An Analysis of Large Elastic Deflections in Heated Sheet-Stringer Panels".

9.22 TR 57-373 June 1958
Ishimoto, T.: "Analytical Studies of Aircraft Structures Exposed to Transient External Heating - Summary Report of Thermal Response Studies".

9.23 TR 57-442 March 1958
Huang, P. C., and Van Der Maas, C. J.: "Combined Effects of Axial Load, Thermal Stress, and Creep in Flat Plates".

9.24 TR 57-442, Supplement I February 1959
Huang, P. C., and Van Der Maas, C. J.: "Combined Effects of Axial Load, Thermal Stress, and Creep in Flat Plates - I - Large-Deflection Analysis of Buckled Plates Under Thermal Effects". Method for calculating critical buckling loads and post-buckling behavior of plates subjected to the following temperature distributions: uniform; hot at the center, varying linearly to cool at the edges; and cool in the center, varying linearly to hot at the edges.

9.25 TR 57-754 Part I January 1958
Mills, W. R.: "Procedures for Including Temperature Effects in Structural Analyses of Elastic Wings. I - An Equivalent Plate Method of Structural Analysis for Elevated Temperature Structures". A study of the structural analysis of a heated wing with emphasis on the additions or changes required in the standard nonthermal analysis methods to accommodate an arbitrary temperature distribution in the structure. The coupling between bending deflections and neutral surface stresses is considered.

II.B.9. Wright Air Development Center (Cont'd)

9.26 TR 57-754 Part II May 1959
Schmit, L. A., and Balmer, H. A.: "Procedures for Including Temperature Effects in Structural Analyses of Elastic Wings. II - A Digital Computer Solution for the Equivalent Plate Method of Thermoelastic Analysis". A method formulated for analyzing the static aeroelastic behavior of thin, low aspect-ratio wings subjected to elevated temperatures and high wing loadings including coupling between aerodynamic pressures and thermoelastic distortions as well as coupling between the bending and stretching of the plate.

9.27 TR 57-754 Part III March 1960
Cener, D.: "Procedures for Including Temperature Effects in Structural Analyses of Elastic Wings. III - Static Tests of Two Large Deflection Wing Models". Description of large-deflection experiments to test the nonlinear behavior of thin wings with a carry-through structure, under high surface loadings and high temperatures.

9.28 TR 57-754 Part IV January 1960
Balmer, H. A., and Foss, K. A.: "Procedures for Including Temperature Effects in Structural Analyses of Elastic Wings. IV - Further Digital Computer Solutions for the Equivalent Plate Method of Thermoelastic Analysis".

9.29 TR 57-754 Part V January 1960
Balmer, H. A., and Foss, K. A.: "Procedures for Including Temperature Effects in Structural Analyses of Elastic Wings. V - Correlation of Analysis with Static Tests of Two Large Deflection Wing Models".

9.30 TR 58-104 April 1958
Abir, D.; Hoff, N. J.; Nardo, S. V.; Pohle, F. V.; Vafakos, W.; and Wan, K. S.: "Thermal Buckling of Circular Cylindrical and Conical Thin-Walled Shells". Experimental and theoretical investigation of temperature distribution, thermal stresses, and buckling in thin-walled circular cylindrical and conical shells. Both reinforced and unreinforced types are considered.

9.31 TR 58-294 July 1958
Padlog, J. and Schnitt, A.: "A Study of Creep, Creep-Fatigue, and Thermal-Stress-Fatigue in Airframes Subject to Aerodynamic Heating". A method of analysis was developed to determine the state of stress and strain and the resulting bending deformations in a multiweb structure under applied time-dependent, combined thermal and mechanical stresses in the presence of creep.

II.B.9. Wright Air Development Center (Cont'd)

9.32 TR 58-378 Part III December 1959
Gallagher, R. H.; Quinn, J. F., and Turrentine, D.: "Thermal Effects on Static Aeroelastic Stability and Control, Part III - Experimental and Analytical Methods for the Determination of Thermally-Affected Wing Deflectional Behavior". Experimental and analytical techniques for the evaluation of influence coefficients for wings subject to elevated temperatures and temperature gradients are discussed. Details of two tests, with results, are given. The effects of material property deterioration, mid-plane thermal forces, and deformations due to thermal expansion are each taken into account.

9.33 TR 58-685 December 1958
Blackstock, W. J.: "Structural Behavior of Box-Beams Under the Influence of Combined Thermal and Dynamic Inputs". An experimental and theoretical study of the effect of combined static, dynamic, and thermal loads on cantilevered single-cell extruded aluminum box beams. Studies were performed in both the elastic and post failure response regions.

9.34 TR 58-686 December 1958
Blackstock, W. J.: "Some Effects of Thermal Stresses on Stiffness Reduction of Plane, Constant-Thickness, Rectangular and Delta Specimens". Study to determine the effects of thermal stresses on structural stiffness of simple plate-like elements. Two plate specimens were cantilever mounted and irradiated on one surface in such a manner as to provide chordwise temperature gradients sufficiently severe to generate thermal stress distributions of realistic proportions. Correlation between experimental results and existing theoretical predictions, as well as extensions of the latter, were performed.

9.35 TR 59-2 March 1959
Huang, P. C., and Van Der Maas, C. J.: "Theoretical and Experimental Studies of the Stresses and Strains Around Cutouts in Loaded, Unevenly Heated Plates". Method for calculating the stresses and strains in unevenly heated flat plates with discontinuities. The method is limited to elastic loads in the plane of the plate and to temperature and strain distributions which are two-dimensional.

9.36 TR 59-18 May 1959 SECRET
Rattinger, I., and Gallagher, R. H.: "Investigation and Design Study for Fuel Stowage in High Performance Aircraft".

9.37 TR 59-22 Part II February 1961
Bloom, M. H.: "Aerodynamic and Structural Analyses of Radome Shells".

II.B.9. Wright Air Development Center (Cont'd)

9.38 TR 59-178 February 1959
Barrekette, E. S.: "Thermoelastic Stresses in Beams". Analysis of thermoelastic stresses in elastic free beams of arbitrary constant cross-section under an arbitrary temperature distribution is made by solving the differential equations by successive approximations. A numerical example of a beam of circular cross section with temperature varying axially is presented.

9.39 TR 59-482 July 1959
Buckley, W. H., and Strasser, G.: "Study of Design Criteria for Structures Subject to Aerodynamic Heating". Discussion of the influences of heating, to aid in the establishment of an adequate philosophy for aircraft structural design. The adequacy of present design philosophy is considered, and a summary of findings pertinent to the establishment of adequate design criteria for heated structures is presented.

9.40 TR 59-559 February 1960
Harder, R. L., et al: "Supersonic Flutter Analyses Including Aerodynamic Heating Effects".

9.41 TR 60-229 November 1959
Gallagher, R. H.; Quinn, J. F., and Turrentine, D.: "Thermal Effects on Static Aeroelastic Stability and Control - Description and Results of Tests Conducted to Determine the Thermally Affected Deflectional Behavior of Corrugated Multiweb Wing Structures". Presents details of the models, apparatus, instrumentation and results of tests conducted on thermal stress alleviated models which were then converted to thermally restrained structures and subjected to further tests. Influence coefficients for each specified temperature distribution were determined.

9.42 TR 60-271 April 1960
Padlog, J.; Huff, R. D., and Holloway, G. F.: "Inelastic Behavior of Structures Subjected to Cyclic Thermal and Mechanical Stressing Conditions". Analysis of structures subjected to varying thermal and mechanical stressing conditions. Consideration is given to the accumulation of time-independent plastic and creep strains.

9.43 TR 60-305 May 1961
Scipio II, L. A.; Chien, S.; Moses, J. A., and Singh, M.: "Viscoelastic Behavior of Surfaces of Revolution Under Combined Mechanical and Thermal Loads". The Appendix A.2 contains some mathematical details on the elastic analysis of a thin conical shell of constant thickness under constant external pressure and thermal loads. In general the report is devoted to thermoviscoelasticity, including the general theory of heat

II.B.9. Wright Air Development Center (Cont'd)

9.43 (Cont'd)

conduction, thermal stresses, deformations produced by thermal flow in the viscoelastic media and the reverse effect of temperature distribution produced by the elastic and viscous deformation.

9.44 TR 60-410 Part I August 1960, Part II August 1961
Douglas Aircraft Corp: "Investigation of Thermal Effects on Structural Fatigue". Redundant force stress analysis of box beam specimens and coupons notched by a centrally located hole was undertaken to determine stress distribution under test loadings. Behavior of advanced structures under constant amplitude and spectrum fatigue loading is compared to that of detail specimens to determine the most elementary valid representation of the complex structure under environmental loading.

9.45 TR 60-517 Vol. I, Sept. 1960
Switzky, H., Newman, M., and Forray, M.: "Thermo-Structural Analysis Manual".

9.46 TR 60-541 Parts I and II April 1960
Huang, P. C., and Van Der Maas, C. J.: "Time-Dependent, Elasto-Plastic Bending Analysis for Structures Under Arbitrary Load-Temperature Environments. I - Analysis Development and Digital Program. II - Experimental Verification". Presents a theoretical and experimental investigation of the time-dependent stress-strain relationship in an unevenly heated beam-type structure. The method permits the analysis of thermal stresses, creep stresses, and residual stresses in the elastic, elastoplastic, or plastic ranges. Applied loads and temperatures may vary arbitrarily with time. A limited study of the sequential effects of load and temperature on a plate was also made.

9.47 TR 61-128 August 1961
Ebcioglu, I. K.: "Thermo-Elastic Equations for a Sandwich Panel Under Arbitrary Temperature Distribution, Transverse Load and Edge Compression". Expressions for the deflection of a sandwich panel subjected to an arbitrary temperature distribution, transverse load and edge compression are presented. The core is assumed to be orthotropic. Face thickness and material are variable. The equations and boundary conditions are formulated from the principles of mechanics, virtual displacements and the calculus of variations. A numerical example is included.

9.48 TR 61-151 January 1962
Lobbett, J. W. and Robb, E. A.: "Thermo-Mechanical Analysis of Structural Joint Study". Investigation of simple lap and butt that are

II.B.9. Wright Air Development Center (Cont'd)

9.48 (Cont'd)

bolted, brazed, and spotwelded. Examples are given showing the variation of temperature, load, and stress with pertinent geometric parameters. A test program consisting of photothermoelastic tests, strain distribution tests, and ultimate tests was conducted to substantiate analytical methods and to explore uniform and nonuniform elevated temperatures and load recovery cases. Application of the redundant force method is discussed.

9.49 TR 61-152 January 1962
Warren, D. S., Castle, R. A., and Gloria R. C.: "An Evaluation of the State-of-the-Art of Thermo-Mechanical Analysis of Structures". The principal structural theories considered are the matrix force method, the matrix displacement method and the direct analog method. The various schemes for discrete idealization of flight structures are also treated. Consideration is given to stresses and flexibility.

9.50 TR 61-537 Part I, November 1961
Forray, M. J., Newman, M., and Kossar, J.: "Thermal Stresses and Deflections in Rectangular Panels Part I - The Analysis and Test of Rectangular Panels with Temperature Gradients Through the Thickness".

9.51 ASD-TDR-62-937 June, 1962
McCown, J. W., Wilks, C. R., Gagola, L. J., Hotchkiss, H. H., Schwartz, M. M., and Miller, J. E.: "Manufacturing Methods and Design Procedures of Brazed Refractory Metal Honeycomb Sandwich Panels". Interim Technical Documentary Progress Report, 20 February 1962 - 1 June 1962. Discusses the evaluation of thermal deflections and thermal stress analysis of shear test panels of sandwich construction on post supports. An approximate method of thermal deflection evaluation for the case at facings at two different temperatures is presented.

9.52 TR 61-92 July, 1961
Makemson, R. L., and Switzky, H.: "The Development and Evaluation of a Technique for the Determination and Description of Loads and Strains in Hot Structures". Develops and experimentally demonstrates instrumentation procedures and methods of data analysis. Techniques are applicable to either flight or laboratory structure testing.

10. Companies, Universities, Institutes, Etc.

Company Reports

Bell Aerosystems Company (Formerly Bell Aircraft Corp.)

10.1 Report No. 02-984-033 Feb. 20, 1956
Wolko, H. S.: "Thermal Gradients, Stresses and Deflections in Stiffened Structures". Analytical solutions are presented for the transient temperature distribution and thermal stresses in typical elements representative of built-up aircraft structures. The analysis includes the effect of thermal resistance in skin-web joints. Charts are presented which permit rapid estimation of the thermal stresses in built-up structures in terms of convenient dimensionless parameters.

General Electric Co.

10.2 Report No. TIS R59SD344 April 13, 1959
Hess, T. E.: "Thermal Stresses in an Orthotropic Spherical Shell with a Radial Temperature Gradient".

10.3 Report APEX-480 (Atomic Product Division) May 1959
Ross, A. L.: "Thermal Stress Analysis of Finite Sections". A general method, applicable to plane-stress or plane-strain problems, is described for finding the thermal stresses in finite, simply connected regions. The thermal stresses are shown to be analogous to the bending stresses developed in thin, flat plates of the same dimensions clamped along their edges and loaded by a surface pressure distribution determined from the temperature distribution of the original thermal-stress problem.

Lockheed Aircraft Corp.

10.4 TR LMSD-288139 (Missiles and Space Division) Jan. 1960
Tsui, E., Stern, P., et al: "General Research in Flight Sciences-Mechanics of Deformable Bodies - Vol. II Chap. X. Elasto-Plastic Analysis of Shells of Revolution Subjected to Heating and External Loads".

Northrop Aircraft, Inc.

10.5 Anon: "Thermal Stress Handbook, Analysis Methods" June 1957. The purpose of this handbook is to acquaint the designer and the structures engineer with the fundamental aspects of the effect of temperature and temperature differences on primary load carrying members in aircraft structures.

II.B.10.. Companies, Universities, Institutes, Etc. (Cont'd.)

Company Reports (Cont'd)

Republic Aircraft Corp.

10.6 Report No. RAC-679-1 Sept. 1960
(Published as WADD TR 60-517)
Switzky, H., Forray, M. and Newman, M.: "Thermo-Structural Analysis Manual" Volumes I and II. A compilation of methods of solution for thermal stress problems. Volume I considers determinant and indeterminant beams and frames, riveted or bolted joints, plates and axially symmetric shells. For more complex linear problems, a general method is presented which reduces the thermal stress problem to an equivalent mechanical loading problem. Volume II extends the treatment to non-linear analysis of beams and plates and to axisymmetric thermo-elastic analysis of thin shells.

University Reports

Brown University

10.7 TR 1 (Division of Applied Mathematics) Sept., 1959
Morland, L. W., and Lee, E. H.; "Stress Analysis for Linear Viscoelastic with Temperature Variation".

College of Aeronautics (Cranfield, England)

10.8 Note 80 Jan. 1958
Houghton, D., and Chan, A.S.L.: "Discontinuity Stresses at the Junction of a Pressurized Spherical Shell and a Cylinder". An analysis of the forces and moments occurring at the junction of a pressurized spherical shell with an intersecting cylinder. The additional effects of having a temperature gradient along the length of the cylinder and the effect of a jointing ring are considered.

10.9 Note 82 Apr. 1958
Johns, D. J.: "Optimum Design of a Multicell Box Subjected to a Given Bending Moment and Temperature Distribution". Iterative method by which the optimum geometry of a multicell box of given depth can be found in order to sustain bending and thermal stresses.

10.10 Note 83 July 1958
Johns, D. J.: "Thermal Stresses in Thin Cylindrical Shells Stiffened by Plane Bulkheads for Arbitrary Temperature Distributions". A development of a formula for the thermal stresses resulting near the joint of a cylinder and internal bulkhead due to arbitrary temperature distributions in the

II.B.10. Companies, Universities, Institutes, Etc. (Cont'd.)

10.10 (Cont'd)

configuration and to the consequent forces and moments at the joint. Axial temperature variation in the shell must be a polynomial of positive order less than, or equal to, three.

10.11 Note 84 Jul. 1958
Lempriere, B. M.: "Thermal Stresses in a Box Structure". Analysis using an energy method to determine the thermal stresses in a finite-length box structure resulting from uniform skin heating. The solution depends upon an eighth order differential equation with constant coefficients.

10.12 Report CAR 147 May, 1961
Johns, D. J., Houghton, D. S. and Webber, J.P.H. "Buckling Due to Thermal Stress of Cylindrical Shells Subjected to Axial Temperature Distributions". Theoretical and experimental investigation of the thermal-stress distributions in uniform circular cylindrical shells due to axial temperature distributions. Account is taken of the presence of a cooler stiffening bulkhead. The possibility of thermal buckling of the shell due to the circumferential-discontinuity stress is examined with use of Donnell's shell equation.

10.13 Note 105 Aug. 1960
Webber, J.P.H. and Houghton, D. S.: "Thermal Buckling of a Free Circular Plate". Considers the buckling of a free circular plate subjected to a temperature field which varies only in the radial direction. The mode of deflection and form of the temperature distribution are first measured experimentally. Expressions are developed for the thermal stresses and the deflection mode of the plate, which are used for a theoretical small deflection energy analysis.

New York University

10.14 Report 61-2 Feb., 1961
Shaffer, B. W. and Levitsky, M.: "Thermal Bond Stresses in Case-Bonded Viscoelastic Propellant Disks".

University of Illinois

10.15 T. and A. M. Report No. 124 October 1957
Langhaar, H. L. and Boresi, A. P.: "A General Investigation of Thermal Stresses in Shells".

II.B.10. Companies, Universities, Institutes, Etc. (Cont'd.)

University Reports (Cont'd)

University of Illinois (Cont'd.)

10.16 T. and A. M. Report No. 131 March 1958
Langhaar, H. L. and Boresi, A. P.: "Thermal Stress Problems of Shells".

Institution Reports

David W. Taylor Model Basin (U.S. Navy)

10.17 Report 937 June 1955
Jasper, N. H.; "Temperature-Induced Stresses in Beams and Ships". One dimensional thermal stresses are computed for non-homogeneous hollow beams of uniform cross section and temperature distribution along the length. Method of superimposing stress to prevent thermal expansion with stresses to restore zero net axial force and transverse moments is used.

10.18 Report 1327 (Research and Development) April 1960
(Structural Mechanics Laboratory)
Krenzke, M. A.: "Effect of Initial Deflections and Residual Welding Stresses on Elastic Behavior and Collapse Pressure of Stiffened Cylinders Subjected to External Hydrostatic Pressure". Investigation conducted on four stiffened cylinders, fabricated by welding and subjected to external hydrostatic pressure. The tests show that initial deflections and residual stresses must be considered in calculating the collapse strength of welded stiffened cylinders.

National Gas Turbine Establishment (NGTE), (Great Britain)

10.19 Memo M.263 February 1956
Howe, P.W.H.: "Thermal Shock Stresses in a Cylinder of Rectangular Cross-Section".

10.20 Report R.226 July, 1958
Glenny, E. and Roysten, M. G.: "Transient Thermal Stresses Promoted by the Rapid Heating and Cooling of Brittle Circular Cylinders". Experimental investigation on the validity of the theory for calculating transient thermal stresses in brittle circular cylinders produced by rapid heating and rapid cooling.

II.B.10. Companies, Universities, Institutes, Ete. (Cont'd.)

Institution Reports (Cont'd)

Grumman Aireraft Engineering Corp.

10.21 Report No. ADR 02-12-62.1, May 1962
Lansing, W., Jones, I. W., and Ratner, P.: "Non-Linear Analysis of Heated, Cambered Wings by the Matrix Foree Method". The matrix foree method for complex strueture analysis is presented and expanded in detail for (1) determining the change in flexibility oceurring when thermal stresses are present, and the magnitude of these stresses necessary to cause buckling, (2) including the non-linear effect of large defleetions by an iterative procedure, and (3) analyzing a wing that is initially slightly cambered and warped with either or both of the aforementioned effects present. An example is included to illustrate the application and to indicate the nature and magnitude of the effects being examined.

10.22 A. and E. S. Report 62-2 April 1962
Lianis, G., and Valanis, K. C.: "The Linearization of the Problem of Transient Thermo-visco-elastic Stresses".

10.23 A. and E. S. Report 62-3 May 1962
Valanis, K. C. and Lianis, G.: "Methods of Analysis of Transient Thermal Stresses in Thermorheologieally Simple Viseoelastic Solids".

10.24 Report TR 20 June, 1962
Koh, S. L. and Eringen, A. C.: "On the Foundations of Non-Linear Thermo-viseoelastieity".

C. SPECIAL PUBLICATIONS

Proceedings of the Conference on High-Speed Aeronautics
Polytechnic Institute of Brooklyn, New York 1955

1 Broglio, L.,: "Balance Method in Thermal Stress Analysis", pp. 189-211. Discussion of preliminary results of work dealing with thermal stresses. The problems have been solved with the help of the "balance method" following a general and uniform technique.

2 Duberg, J. E.,: "High Temperature Structural Research at the National Advisory Committee for Aeronautics", pp. 213-232. A review of experimental work on effects of elevated temperature.

3 Horton, W. H.,: "The Influence of Kinetic Heating on the Design and Testing of Aircraft Structures", pp. 233-270. A broad survey of the effects of aerodynamic heating on aircraft structures.

Proceedings of the Society for Experimental Stress Analysis Vol. 14, No. 2, 1957

4 Kotanchik, J. N.,: "Experimental Research on Aircraft Structures at Elevated Temperatures", pp. 67-80. Reviews the equipment and methods used at the Langley Laboratory of the NACA in experimental research on aircraft structures at elevated temperatures.

Proceedings of the Florida Conference in High-Speed Aerodynamics and Structures January 21-24, 1957
(U.S.A.F. Air Research & Development Command Technical Report TR57-46 Vol. 1)

5 Taylor, J. W.: "Design Requirements and Laboratory Simulation of the Kinetic Heating of Aircraft Structures".

6 Riedinger, L. A.: "Thermal Stress Analysis by Energy Methods".

Proceedings of the Third U. S. National Congress of Applied Mechanics
American Society of Mechanical Engineers, June 1958

7 Flugge, W., and Conrad, D. A.,: "Thermal Singularities for Cylindrical Shells", p. 321-328.

8 Goodier, J. N.,: "Formulas for Overall Thermoelastic Deformation, p. 343-345.

9 Hanson, K. L., and Horvay, G.,: "Thermal Stresses in a Sector Prism", p. 347-356.

II.C. Special Publications (Cont'd)

10 Langhaar, H. L., and Boresi, A. P.,: "Strain Energy and Equilibrium of a Shell Subjected to Arbitrary Temperature Distribution", p. 393-399.

11 Small, N. C.,: "Pressure and Thermal Stress Analysis of Plate-Type Fuel Subassemblies", p. 451-459.

12 Vinson, J. R.,: "Thermal Stresses in Laminated Circular Plates", p. 467-471.

13 Sternberg, E.,: "On Transient Thermal Stresses In Linear Viscoelasticity", p. 673-683.

Problems of Continuum Mechanics, Society for Industrial and Applied Mathematics, Philadelphia, 1961

14 Nowacki, W.: "On Some Dynamical Problems of Thermoelasticity", pp 291-305.

15 Sneddon, I. N. and Tait, R. J.: "On Lur'e's Solution of the Equations of Thermoelastic Equilibrium", pp. 497-512.

D. BOOKS

1 Gatewood, B. E.: "Thermal Stresses" McGraw-Hill Book Co., Inc., New York 1957. All phases of the analysis and design of structures at elevated temperatures are covered, including temperature distribution, elastic and inelastic thermal stresses, combined and applied thermal stresses, allowable stresses of various materials at elevated temperatures, and the buckling, deflection, stiffness, fatigue, shock, and flutter effects of elevated temperatures.

2 Hoff, N. J. (Editor): "High Temperature Effects in Aircraft Structures". Agardograph 28 Pergamon Press, 1958.

3 Boley, B. A. and Weiner, J. H.: "Theory of Thermal Stresses" John Wiley, New York, 1960.
The book presents the fundamental principles of thermoelasticity and methods of solution for related problems. It formulates a unified treatment of the theory of thermal stresses, starting with the basic principles of thermodynamics, heat transfer theory, elasticity and creep, and then proceeding to the practical methods of solution used in stress analysis.

II.D Books (Cont'd)

4 Alberi, A. and Rosencran C.: "Structures of Carrier and Space Vehicles". Advances in Space Science and Technology, Volume 3, Edited by F. I. Ordway, III. Academic Press, New York, 1961. Pages 297-419.

Treats the general subjects of structural design conditions, vehicle structures, and materials. On the topic of thermal stresses the classical elasticity problem is presented. In addition, equations are given for thermal stresses in box beams, and thermal buckling of plates.

III. FOREIGN LANGUAGE REFERENCES

A. GERMAN LANGUAGE

1. Ingenieur Archiv

1955

1.1 Zoller, K.: "Thermal Stress During Heating of a Drum" (in German) p. 51-60. Deals with an infinite cylindrical shell with outer wall insulated, inner wall subject to a time dependent temperature distribution. Graphs are given for inner and outer face temperatures.

1955 - No. 3

1.2 Tremmel, E.: "Contribution to the Problem of Thermal Stresses in Disks" (in German) p. 159-171. Solves the problem of a circular tube with eccentric circular hole wherein the temperature distribution is independent of time; temperature is constant along inner and along outer boundary.

1956 - No. 1

1.3 Trostel, R.: "Transient Thermal Stresses in Hollow Cylinders with Circular Cross-Section", p. 1-26. (in German). Investigation of the state of stress caused by nonstationary, rotationally symmetrical temperature fields in hollow cylinders whose surfaces are subjected to local arbitrary thermal boundary effects.

1956 - No. 6

1.4 Trostel, R.: "Transient Thermal Stresses in a Hollow Sphere", (in German), p. 373-391. Investigation of the state of stress produced by rotationally symmetric temperature fields in hollow spheres whose internal and external surfaces are under the influence of thermal edge effects.

1957 - No. 5

1.5 Baehr, H. D.: "Nonstationary Thermal Stresses in Composite Brick-Metal Containers and the Computation of Wall Thicknesses with Help of a Temperature Graph," (in German), p. 330-349.

1958 - March

1.6 Trostel, R.: "Thermal Stresses in Hollow Cylinders with Temperature-dependent Properties" (in German), p. 134-142. Calculation of thermal stress in hollow cylinders whose material values depend upon temperature.

III.A.1. Ingenieur Archiv (Cont'd)

1959 - March

1.7 Parkus, H.: "Stresses in the Cooling of a Sphere" (in German), p. 251-254. Treats the thermal stresses in an ideal elastic-plastic incompressible sphere subjected to sudden surface cooling.

1959 - March

1.8 Roy, M.: "Thermodynamic Theory Derived from Linear Elasticity" (in French), 277-280.

2. Zeitschrift fur angewandte Matematik und Mechanik (ZAMM)

1954 - Apr./May

2.1 Hieke, M.: "On a Problem of Discontinuous Thermal Stresses in the Plane" (in German), p. 121-139. Solution for the wedge of a circular cylinder of infinite length and radius kept at constant temperature while the remainder of the cylinder is kept at zero temperature. Temperature is constant in the axial direction and the cylinder is in state of plane strain. Solution of classical equations of elasticity is given in terms of Airy's stress function.

1955 - Aug.

2.2 Hieke, M.: "The Indirect Determination of the Airy Function for Discontinuous Thermal Stresses" (in German), p. 285-294. Stresses due to stepped temperature distribution and consequent discontinuous density changes are investigated. Cases treated include the circular cylinder with concentric and eccentric heated parts, and a cylinder in which the surface of discontinuity is a plane.

1956 - Sept./Oct

2.3 Bader, W.: "Numerical Determination of Thermal Stresses" (in German), p. 331-339. Particular solutions for Poisson's equation of the displacement potential are determined. A simple method of solution for the field of displacement, which is superposed in order to fulfill the boundary conditions, is proposed. As an example of the method, a circular cylinder with ends at constant different temperatures and radiation at the curved surface is examined. Graphs of stress and temperature distribution for cylinders of various length-to-diameter ratios are given.

1960 - Oct./Nov.

2.4 Aggarwala, B. D.: "Thermal Stresses in Spherical Shells of Visco-Elastic Materials," p. 482-488. Derivation of an expression for thermal stresses in spherical shells of general linear material whose properties vary with temperature. The corresponding results for a Maxwell solid are obtained as a particular example, and some numerical results are given.

III.A.2. Zeitschrift fur angewandte Mathematik und Mechanik (ZAMM) (Cont'd)

1961 - March

2.5 Das, B. R.: "Thermo-Elastic Stresses in an Infinite Slab Resting on an Insulating Plane and Having an Isolated Heat Source at the Upper Surface", p. 136-138. Application of Sharma's method to the determination of the thermoelastic stresses in an infinite slab, having one side rigidly fixed to an insulating plane, and a point heat source at the upper surface.

3. Zeitschrift fur angewandte Mathematik und Physik (ZAMP)

1956 - May

3.1 Prager, W.: "Thermal Stresses in Viscoelastic Structures" p. 230-238. Analysis of the thermomechanical behavior of a statically indeterminate truss which consists of Maxwell bars, taking into account the effects of typical variations of loads and temperatures on truss stresses.

1957 - No. 2

3.2 Sharma, B. D.: "Stresses due to a Nucleus of Thermoelastic Strain (I) in an Infinite Elastic Solid with Spherical Cavity and (II) in a Solid Elastic Sphere", p. 142-150. The displacements and stresses at the surface of a known cavity in an infinite elastic solid are obtained in the form of a series solution superposed on the infinite solid solution. The solution for deflections and stresses at the surface of a solid elastic sphere with a localized heated region is obtained in a similar manner. Numerical solutions are given.

1959 - No. 6

3.3 Nowinski, J.: "Thermoelastic Problem for an Isotropic Sphere with Temperature-Dependent Properties" (in English), p. 565-575. Analysis of an isotropic sphere, solid or hollow, subjected to arbitrary spherically symmetrical temperature fields. Expressions are derived for thermal stresses in materials in which Young's modulus and coefficient of thermal expansion vary arbitrarily with temperature.

1960 - Nov. 25

3.4 Muki, R. and Sternberg, E.: "Steady Thermal Stresses in an Elastic Cone" p. 471-496. Thermoplastic investigation of thermal stresses produced in a solid, homogeneous and isotropic, elastic cone of semi-infinite extent, which is free from external loads but exposed to a stationary discontinuous surface temperature: the tip of the cone (up to a given distance from the apex) is held at a constant temperature, while the remainder of the boundary is maintained at another uniform temperature.

4. Oesterreich Ingenieur Archiv (Austria)

1954 - No. 2-3

4.1 Melan, E.: "Thermal Stresses Generated in Rotating Temperature Fields" (in German), p. 165-170. The determination of the thermal stress field in a thin circular plate is considered for the case of a steady temperature field. The analysis incorporates the concepts of the theory of generalized plane stress.

1955 - No. 2-3

4.2 Melan, E.: "Stresses due to Nonsteady Temperature Fields" (in German), p. 171-175. A general expression for subject two-dimensional stresses is given in terms of the thermoelastic displacement potential. As an illustration, thermal stresses due to sudden application of heat at a point in a large thin disk are found.

1957 - No. 4

4.3 Jung, H.: "Determination of Thermal Stresses in Unevenly Heated Furnaces" (in German), p. 257-264.

1961 - No. 1

4.4 Boswirth, L.: "Thermal Stresses in a Triangular Wing" (in German), p. 30-48. Develops a method of calculating thermal stresses in delta wings by assuming the structure is made up of portions of four conical shells. Temperature field is taken as symmetrical about vertical plane of symmetry, but is otherwise arbitrary. Numerical example is worked for isosceles-triangular wing with right-angle vertex, moments along axis of symmetry being calculated and plotted.

1961 - No.

4.5 Nowacki, W.: "Propagation of Thermal Stresses in Viscoelastic Bodies" (in German), p. 115-129.

5. Miscellaneous

Osterriech Akad. Wiss. Math-Nat. Kl-Anz. 1954 - No. 12

5.1 Shull, G. H.: "Thermal Stresses as Consequence of Quasi-Stationary Temperature Distribution" p. 183-190. Treats thin sheets and an infinite three-dimensional medium.

Tech. Mitt. Krupp July 1955

5.2 Dietze, H. D.: "Thermal Stress in a Sphere due to a Periodic Fluctuation of the Surface Temperature", p. 62-65.

Osteriech Akad. Wiss. Math-Nat. Kl-Anz. 1955 - No. 11

5.3 Melan, E.: "Thermal Stresses During the Cooling of a Sphere", p. 202-224. Solves for the transient thermal stresses when the sphere is initially

III.A.5 Miscellaneous (Cont'd)

at a uniform temperature and cools to ambient through a boundary conductance.

Forsch, Geb. Ing.-Wes. 1957 - No. 1-2

5.4 Endres, W.: "Thermal Stresses in Pipelines", p. 33-37. On the thermal stress in bent tubes.

Beton Und Stahlbeton Feb. 1958

5.5 Walter, H. E.: "Deflection of Structural Elements due to the Influence of Temperature", p. 40-42.

Stahlbau May 1958

5.6 Kloppel, K., and Schonbach, W.: "Thermal Stresses in Rectangular Plates", p. 122-125. Thermal stress distributions are given for rectangular plates; the type of temperature field considered is steady and varies only in a direction parallel to one pair of plate's edges.

Deutsche Versuchsanstalt Luftfahrt Report No. 78 Nov. 1958

5.7 Schnell, W., and Fischer, G.: "Buckling Value Calculation for Plates Subject to Nonuniform Thermal Stress by Method of Collocation." Method for calculating the buckling values of plates subjected to thermal stress. The procedure is used to determine the critical stresses leading to the buckling in the skin of a wing cross section for any temperature distribution.

Forsch. Geb. Ing.-Wes April 1961

5.8 Stanisic, M. M.: "On an Exact Solution of the Thermal Stress Problem for a Body Composed of Concentric, Isotropic, Spherical Shells". Numerical evaluation of the stresses at the inner and outer boundaries of four contiguous concentric spherical shells of differing material constants, when the system is subjected to a uniform temperature gradient.

Bautechnik Aug. 1961

5.9 Opladen, K.: "Analysis of Conical and Cylindrical Shells of Variable Wall Thickness under Axisymmetric Loads and Temperatures".

Ingenieur Sept. 1961

5.10 de Pater, C.: "Thermal Stresses in Tube Plates" (in English). Analysis of a thick circular perforated plate with a steady-state temperature difference between the plate surfaces.

VDI Zeitshrift Sept. 21, 1961

5.11 Hosp, E.: "Application of the Photoelastic Freezing Method for the Determination of Thermal Stresses in Disks."

III.A.5 Miscellaneous (Cont'd)

VDI Zeitschrift, February 11, 1962, p. 203-206 Boswirth, L.:

5.12 "A Nondimensional Characteristic Quantity for Thermal Stresses in Linear Heating and Cooling Processes". Derivation of nondimensional characteristic quantities for the elastic thermal stresses that occur at the surfaces of slabs, cylinders, or spheres due to linear (with time) heating or cooling. The expressions afford a means of determining such quantities as the maximum heating (or cooling) rates within the elastic range. It is shown that a characteristic nondimensional quantity, suitable as a basis for model tests or for the classification of experimental data, can be deduced for any body of any shape.

Bautechnik January 1962 pp. 7-11

5.13 Sayar, K. and Seetzen, J.: "Thermal Stresses in Spherical Concrete Shielding Following Radiation Absorption". Expressions are developed for the separate heating effects of x-rays and neutrons, and also for the temperature distribution and the thermal stresses within the concrete shield.

VDI Zeitschrift March 1962 pp. 378-381

5.14 Varga, L. and Szilagyi, L.: "Determination of Thermal Stresses Caused by Rings Fastened on Cylindrical Containers". Determination of the thermal stresses resulting from the unequal thermal coefficients of expansion of the container and external stiffening rings.

B. POLAND

(All references cited are in Polish unless otherwise stated.)

1. Archiwum Mechaniki Stosowanej

1954 - No. 3

1.1 Nowacki, W.: "Thermal Stress in Anisotropic Bodies", p. 481-492.

1955 - No. 2

1.2 Nowinski, J., Olszak, W., and Urbanowski, W.: "On Thermoelastic Problems in the Case of a Body with an Arbitrary Type of Curvilinear Orthotrophy", p. 247-264.

1955 - No. 3

1.3 Nowinski, J.: "Thermal Stresses in a Thick-Walled Spherical Vessel of Transversally Isotropic Material", p. 363-374. Solution of title problem for spherical temperature distribution. Problems considered include a hollow and solid sphere and a thin shell.

III.B.1 Archiwum Mechaniki Stosowanej (Cont'd)

1956 - No. 1

1.4 Nowacki, W.: "Thermal Stresses in Cylindrical Shells", p. 69-83. Solutions for various boundary conditions through superposition of the solution for a clamped shell subjected to the influence of temperature and simply supported shell loaded at the edges with moments of types corresponding to the type of support. In the case of simple support or clamping along all edges of the shell, the solution is obtained in terms of simple infinite sums.

1957 - No. 1

1.5 Vodicka, V.: "Stationary Temperature Fields in a Two-Layer Plate", p. 19-24. Analysis to provide a theoretical foundation for solving thermal problems of two-layer tubes.

1.6 Nowacki, W.: "The Stresses in a Thin Plate Due to a Nucleus of Thermoelastic Strain", p. 89-106. Theoretical investigation to determine the stresses due to discontinuous, concentrated thermal action in a thin plate (treated as a two-dimensional problem) with free edges, when the temperature in the surface element is T and that of the remaining region is zero.

1957 - No. 3

1.7 Nowacki, W.: "A Three-Dimensional Thermoelastic Problem with Discontinuous Boundary Conditions", p. 319-324. Analysis to determine the stress in an elastic semi-space in a steady temperature field, under the following conditions: the plane $z = 0$ bounding the elastic semi-space is kept at constant temperature inside the circle of radius $r = a$; the exterior of that circle is thermally insulated; and the semi-space is assumed to be free from stress at the $z = 0$ plane and at infinity.

1.8 Nowakowski, W.: "A Dynamical Problem of Thermoelasticity" (in English) p. 325-334. Closed form solutions for the state of stress in an elastic space due to a concentrated source of heat which is a function of time. Considers three cases of heat source: (1) the Dirac impulse, (2) the Heaviside unit function, (3) a harmonic function. Accounts for the influence of the inertia forces.

1.9 Nowinski, J.: "The Principle of Stationary Free Energy in the Thermoelastic Analysis of Thin-Walled Tubes" (in English), p. 359-369. Basic equations of the theory of thin-walled tubes with open cross sections are derived using the principle of minimum free energy.

III.B.1 Archiwum Mechaniki Stosowanej (Cont'd)

1957 - No. 4

1.10 Ignaczak, J.: "Thermal Displacements in an Elastic Semi-Space Due to Sudden Heating of the Boundary Plane", p. 395-416. Solution of the equations of motion of the theory of thermoelasticity in a semi-space for given boundary and initial conditions. The methods used are based on the elementary properties of operational calculus, in particular on the Fourier integral transformation and a number of properties of the Dirac function.

1957 - No. 5

1.11 Mossakowski, J.: "The State of Stress and Displacement in a Thin Anisotropic Plate Due to a Concentrated Source of Heat", p. 565-577. Development of a relatively general method for solving problems of thermal stress in thin anisotropic plates. The method is illustrated by simple examples, and the influence of thermal and elastic anisotropy on stress distribution is shown.

1.12 Nowacki, W.: "Two Steady-State Thermoelastic Problems" p. 579-592. State of stress in an elastic space and semispace due to a temperature field. The difference between the two problems considered is that of thermal boundary conditions in the z = 0 plane. The solution obtained for the elastic space serves for the construction of the more complex problem, that of determining the stress state in the elastic semispace free from stress in the z = 0 plane.

1957 - No. 6

1.13 Seth, B. R.: "Finite Thermal Strain in Spheres and Circular Cylinders", p. 633-645. Analysis in which a linear stress-strain law, giving sufficiently good results for technical application, is assumed. The resulting differential equations for the case of spheres and circular cylinders are nonlinear. An infinite series solution is obtained for any temperature law.

1958 - No. 1

1.14 Ignaczak, J.: "Thermal Stresses in a Long Cylinder Heated in a Discontinuous Manner over the Lateral Surface", p. 25-34 (in English). Derivation of solutions for thermal stresses in which the method for integrating the equations of thermoelasticity is used by introducing the thermoelastic potential of displacement.

1958 - No. 2

1.15 Ignaczak, J.: "Thermal Displacement in a Non-Homogeneous Elastic Semi-Infinite Space Caused by Sudden Heating of the Boundary" (in English), p. 147-154.

III.B. 1 Archiwum Mechaniki Stosowanej (Cont'd)

1958 - No. 3

1.16 Derski, W.: "The State of Stress in a Thin Circular Ring, Due to a Non-Steady Temperature Field", p. 255-270. Analysis of stresses due to a time-variable temperature field, the temperature distribution being an axially symmetric one. The stresses are determined assuming that the edges are free and that the thermal boundary conditions are in the most general form.

1958 - No. 4

1.17 Derski, W.: "On Transient Thermal Stresses in a Thin Circular Plate", p. 551-558.

1.18 Mossakowska, Z. and Nowacki, W.: "Thermal Stresses in Transversely Isotropic Bodies", p. 569-603. Investigation to determine the state of stress due to the action of a continuous and discontinuous temperature field in an elastic body showing transverse isotropy. The cases of an infinite space, a semispace, and an elastic layer are considered for steady as well as nonsteady temperature fields. A method of solution, based on the displacement function, is developed.

1958 - No. 5

1.19 Ignaczak, J.: "The Stresses Due to a Nucleus of Thermoelastic Strain in a Semi-Infinite Plate Containing a Semicircular Notch", p. 707-713. Solution to the problem of thermal stress due to a nucleus of thermoelastic strain in the neighborhood of a unique semicircular notch. The solution obtained has the form of a series of coefficients that are determined from a linear infinite system of algebraic equations.

1958 - No. 6

1.20 Sololowski, M.: "The Axially Symmetric Thermoelastic Problem of the Infinite Cylinder" (in English) p. 811-824. General relations for the determination of stresses in an infinite cylinder of radius R, due to thermal load, are given in cylindrical coordinates.

1959 - No. 1

1.21 Piechocki, W.: "The Stresses in an Infinite Wedge Due to a Heat Source" (in English) p. 93-109. A thin plate in the form of an infinite wedge with the apex angle and free edges subjected to the action of a point source of heat, located inside the region. The stress components are obtained using the potential of thermoelastic displacement and auxiliary Airy function.

1.22 Nowacki, W.: "Thermal Stresses Due to the Action of Heat Sources in a Viscoelastic Space" p. 111-125. Analysis considering the problem as quasi-static, the inertia terms in the equations of equilibrium being

III.B.1 Archiwum Mechaniki Stosowanej (Cont'd)

rejected. Two ways of solving the problem are described: first, by means of the potential of thermoelastic displacement; second, by the method of Mayzel as generalized to viscoelastic problems.

1959 - No. 2

1.23 Piechocki, W.: "The Stresses in an Infinite Wedge Due to a Nucleus of Thermoelastic Strain" p. 211-219.

1.24 Mossakowski, J.: "Thermal Stresses in an Elastic Space with Discontinuous Physical Properties" (in English) p. 243-258. Solution for the steady heat flow from a point source of heat and of the strain and stress state in a nonhomogeneous infinite space consisting of two perfectly joined semiinfinite spaces of different thermal and elastic properties.

1.25 Nowacki, W.: "Some Dynamic Problems of Thermoelasticity" p. 259-283.

1959 - No. 3

1.26 Piechocki, W.: "The State of Stress in a Circular Disc Due to the Action of a Nucleus of Thermoelastic Strain" (in English), p. 287-295. Using the potential of thermoelastic strain and the Airy function, author determines the Green's function necessary for the determination of the stress in a circular region, due to nuclei of thermoelastic strain distributed in an arbitrary manner.

1959 - No. 5

1.28 Nowacki, W.: "Transient Thermal Stresses in Viscoelastic Bodies" (in English), p. 649-669. Establishes a two-stage method of treating dynamical problems belonging to time-dependent temperature fields in viscoelastic media. The solution consists of solving the quasi-statical problem, then taking into account the influence of inertia forces.

1959 - No. 6

1.29 Nowacki, W.: "Propagation of Thermoelastic Waves in Plates" p. 715-726.

1960 - No. 1

1.30 Mossakowska, Z.: "One-Dimensional Dynamical Problem of Thermoelasticity for an Anisotropic Medium" p. 137-147. Study of the one-dimensional problem of thermoelasticity for the case of an anisotropic half-space. General rectilinear anisotropy is assumed with respect to both the thermal and elastic properties. The field of displacements and stresses, due to the sudden application of a plane heat source or temperature at a specific depth under the edge of the half-space, is determined. Closed form solutions are derived for various thermal and elastic conditions comprising an edge with thermal insulation or zero temperature, as well as for a clamped or free edge.

III.B.1 Archiwum Mechaniki Stosowanej (Cont'd)

1960 - No. 2

1.31 Piechocki, W. and Ignaczak, J.: "Some Problems of Dynamic Distortion in Thermoelastieity" p. 239-278.

1960 - No. 3

1.32 Singh, A.: "Axisymmetrical Thermal Stresses in Transversely Isotropic Bodies" p. 287-304. Stress-funetion approach to the solution of the axisymmetrie steady state thermoelastic problem for a transversely isotropic body in the presenee of the body forces. A mixed boundary value problem for a semi-infinite medium is discussed as an example. Solution in closed form is obtained by means of a Hankel transform. The determination of stresses is set forth in oblique spherical coordinates.

1960 - No. 4

1.33 Ignaczak, J.: "The Axially Symmetrie Boundary-Value Problem of Thermoelasticity for a Hemispherieal Shell of any Thickness"p. 415-435. Analysis of steady-state thermal stresses in a thiek hemispherical shell, free of surface stresses, and located in an axially symmetric temperature field. The thermo elastic problem is reduced to a boundary value problem in elastieity and a general method of eonstructing sequenees of solutions is developed. Speeifie boundary conditions treated are unit temperature near the free edge and zero temperature elsewhere.

1.34 Pieehoeki, W.: "Axisymmetrie Dynamie Problem of Thermoelastieity for a Solid Sphere" p. 553-561. The propagation in a solid sphere of elastie waves generated by a temperature field varying harmonically in time. The solution is obtained as a sum of two funetions, one of whieh has a potential charaeter. The other constitutes the solution of isothermal equations of motion in the theory of elastieity, and also satisfies the eorresponding boundary eonditions.

1960 - No. 5-6

1.35 Pankowski, Z.:: "Stress and Displacement Field Due to a Plane Heat Souree in an Infinite Layered Medium" (in English), p. 749-762. Problem of two homogeneous semi-infinite bodies having different thermal and elastie properties separated by a plane under a uniformly applied heat source parallel to the plane of separation. A elosed form solution for the stresses, displacements and temperature distribution is achieved.

1.36 Ignaczak, J.: "A Plane Problem of Dynamic Thermal Distortion in Thermoelastieity" p. 763-774. Problem of the plane nonstationary thermal distortions in an infinite plate with a reetangular insertion. The problem is eharacterized by a temperature field which is diseontinuous in time and space; and the inertia terms in the thermoelastieity equations without conjugation are taken into aecount. The displacements and states of stress are determined in closed form.

III.B.1. Archiwum Mechaniki Stosowanej (Cont'd)

1961 - No. 2

1.37 Derski, W.: "A Dynamic Problem of Thermoelasticity Concerning a Thin Circular Plate" p. 177-185. Investigation of thermal stresses in a thin circular plate subjected to sudden heating by use of Laplace transforms. For the particular case where the heat exchange between the plate and the surrounding medium is assumed zero, the formulas obtained for the displacements and stresses are given in the form of well-known functions.

1.38 Zorawski, M.: "Moving Dynamic Heat Sources in a Viscoelastic Space and Corresponding Basic Solutions for Moving Sources", p. 257-275.

1.39 Hetnarski, R.: "Coupled One-Dimensional Thermal Shock Problem for Small Times", p. 295-306.

1961 - No. 3

1.40 Ignaczak, J.: "Transient Thermal Stresses in an Elastic Semispace After a Number of Thermal Shock Cycles", p. 327-335. Analysis of the general one-dimensional case of a finite number of thermal shocks at the boundary of a semispace.

1.41 Sokolowski, M.: "A Thermoelastic Problem for a Strip with Discontinuous Boundary Conditions", p. 337-354.

1961 - No. 5

1.42 Ignaczak, J. and Nowacki, W.: "Transversal Vibrations of a Plate, Produced by Heating", p. 651-666.

2. Archiwum Budowy Maszyn

1957 - No. 2

2.1 Nowacki, W.: "Stan Naprezenia w Tarczach Wywolany Dzialaniem Zrodel Ciepla", p. 121-152 (with summaries in English and Russian). Theoretical determination of the components of the thermal stress condition in an infinitely long strip of plate with one heat source, an infinitely long strip of plate with identical heat sources evenly spaced, a semi-infinite strip of plate with one heat source, and a rectangular plate with one heat source.

1957 - No. 3

2.2 Nowacki, W.: "Stan Naprezen Wywolany w Przestrzeni Sprezystej Dzialaniem Chwiloweg Zrodla Ciepla", p. 285-305 (with summaries in English and Russian). Analysis of the stress state in an elastic space and half-space due to the action of an instantaneous source of heat, and

III.B.2. Archiwum Budowy Maszyn (Cont'd)

2.2 (Cont'd) of the stress state in an inelastic half-space caused by a concentrated instantaneous heat source. The latter problem is solved by the method of reflections.

1957 - No. 4

2.3 Nowacki, W.: "Stan Naprezen Wywolany w Polprzestrzeni Sprezystej Dzialaniem Chwilowego Zrodla Ciepla", p. 413-425 (with summaries in English and Russian). Study of the stress distribution in an elastic half-space resulting from an instantaneous heat source in the plane bounding the elastic half-space. The problem is considered as a quasistatic one, and the stress distribution in the elastic half-space thermally insulated in the bounding plane as well as in the case of a constant temperature T = 0 (in the plane) is taken into account. The stress distribution of an unbounded elastic space is determined using the potential of the thermoelastic displacement connected with the temperature field, and its final components are obtained by means of Loves's function. It is shown that these components satisfy any boundary condition in the plane z = 0.

1958 - No. 4

2.4 Derski, W.: "Stresses and Displacements in a Thin Cooling Rib Caused by the Action of Unsteady Heat Flow", p. 449-456.

3. Bulletin Acadamic Polonaise Sci.

1957 - No. 2

3.1 Nowacki, W.: "State of Stress in an Infinite and Semi-Infinite Elastic Space Due to an Instantaneous Source of Heat", p. 77-86.

1957 - No. 3

3.2 Nowacki, W.: "A Quasi-Stationary Thermo-Elastic Problem in Three Dimensions", p. 155-163. Analysis to determine the displacement and stress which occur in an elastic semi-space due to the action of a source of heat (of intensity W) moving with a constant velocity v in the plane bounding the semi-space. The material is assumed to be thermally and elastically isotropic, and material properties are assumed to be independent of temperature and stress. The stress solution is represented by Fourier integrals along with the potential of thermoelastic displacement.

III.B.3 Bulletin Acadamie Polonaise Sci. (Cont'd)

1957 - No. 3

3.3 Nowacki, W.: "The State of Stress in an Elastic Semi-Space Due to an Instantaneous Source of Heat", p. 165-173. Solutions obtained by determining the Green's function for the problem of heat sources constituting continuous functions of time and distributed over a region of the plane z = 0. The inertia terms are disregarded. It is also assumed that the z = 0 phase is thermally insulated, and that the temperature distribution over the plane is zero except for the point where the heat source is located.

1958 - No. 4

3.4 Sokolowski, M.: "Axially-Symmetrical Problems of Thermo-Elasticity for a Cylinder of Unlimited Length", p. 207-210. Presents two solutions for stresses and displacements, the first being for the general case of a sourceless field of temperature, and the second considering a lineariy-distributed source of heat.

1959 - No. 1

3.5 Nowacki, W.: "Thermal Stress Propagation in Viscoelastic Bodies", p. 111-125.

1959 - No. 4

3.6 Nowacki, I. W.: "Thermal Stress Propagation in Viscoelastic Bodies", p. 251-263. Analysis assuming that: (a) an instantaneous source of heat acting in an infinite viscoelastic space results in a temperature and stress field; (b) the viscoelastic medium, of linear characteristic, is isotropic and homogeneous; and (c) the deformations are small and the physical constants are independent of temperature. A displacement equation is derived on the basis of Biot and Berry's relations and the potential of thermoelastic strain is introduced. Inverse Laplace transformation yields the relation between the state of stress and that of strain.

1959 - No. 5

3.7 Ignaczak, J.: "A Dynamic Nucleus of Thermoelastic Strain in an Elastic Infinite Space and Semi-Space" (in English), p. 305-308.

1959 - No. 7-8

3.8 Piechocki, W. and Ignaczak, J.: "Thermal Stresses Due to a Thermal Inclusion in a Circular Ring and a Spherical Shell", p. 419-424.

3.9 Ignaczak, J.: "A Plane Dynamic Problem of Thermoelasticity Concerning a Circular Hole", p. 469-476.

III.B.3 Bulletin Acadamie Polonaise Sci. (Cont'd)

1959 - No. 9

3.10 Piechocki, W.: "A Certain Dynamic Problem of Thermoelasticity Concerning the Circular Disk", p. 513-518.

1960 - No. 1

3.11 Piechocki, W.: "The Problem of the Transient Surface Nucleus of Thermoelastic Strain in an Infinite Elastic Body with a Spherical Cavity", p. 1-4.

1960 - No. 3

3.12 Derski, W.: "On a Certain Dynamic Problem of Elasticity for a Circular Cylinder", p. 135-138.

1960 - No. 4

3.13 Sokolowski, M.: "One-Dimensional Thermoelastic Problems for Elastic Bodies with Material Constants Dependent on Temperature", p. 153-160.

3.14 Zorawski, M.: "States of Stress Generated in a Viscoelastic Semi-Space by a Flat Heat Source", p. 161-166.

1960 - No. 8

3.15 Matczynski, M.: "Axially Symmetric Distribution of Thermal Stresses Generated by Periodic Sources in the Neighborhood of a Long Hole in an Infinite Body", p. 423-428. Analysis of thermal stresses in an elastic space with a cylindrical hole of circular cross section.

1960 - No. 9

3.16 Derski, W.: "On Transient Thermal Stresses in an Infinite Thin Plate", p. 503-507. The one-dimensional problem of thermal elasticity. Temperature distribution in the plate is produced by a point heat source of the Dirac type; inertia terms are taken into account. Variation in radial stress and displacement is plotted in dimensionless coordinates.

1961 - No. 1

3.17 Kapkowski, J. and Lukasiewicz, S.: "The Influence of Temperature on the Shape of Rotating Discs of Uniform Strength" (in English), p. 7-16. An approximate plane stress, plastic solution for the thickness of a rotating disk taking into account a temperature variation across the radius. Numerical results are presented graphically.

1961 - No. 2

3.18 Zorawski, M.: "Dynamic Nucleus of Thermoelastic Strain in Viscoelastic Space", p. 77-84. Determination of the stress-state components for a viscoelastic space loaded by dynamic thermoelastic strain nuclei. Cases considered are: (1) a nucleus of thermoelastic strain homogeneously

III.B.3. Bulletin Acadamie Polonaise Sci. (Cont'd)

3.18 Cont'd distributed on a sphere: (2) a plane nucleus, comprising the symmetric, antisymmetric, and general cases; and (3) a linear nucleus of thermoelastic strain.

1961 - No. 3

3.19 Nowacki, W.: "On the Treatment of the Two-Dimensional Coupled Thermoelastic Problems in Terms of Stresses", (in English), p. 155-161. Analysis of the plane strain of an elastic medium subjected to surface and body forces and a temperature gradient, the field of deformation being coupled with the temperature field. It is shown that the solution of the two-dimensional coupled problem can be obtained in the general ease, involving body forces, with the aid of three stress functions. In the absence of body forces, one stress function is sufficient.

1961 - No. 5

3.20 Nowacki, W.: "Dynamic Distortion Problem", p. 271-276. Formal solution for the displacements in terms of Green's functions and a specified distortion field.

3.21 Nowacki, W.: "A Plane Dynamic Distortion Problem in Stresses", p. 277-282. Solution for the stresses and the stress functions for the plane strain problem in an infinite space under a specified plane distortion field.

3.32 Ignaczak, J.: "Note on the Propagation of Thermal Stresses in a Long Metallic Rod", p. 309-314 (in English). Solution for the one-dimensional coupled thermoelastic field equations associated with an infinite and a semi-infinite thin bar. The traction and temperature at the ends of the bar are assumed to vanish permanently, while the temperature at the initial instant is taken as an arbitrary function of the length-coordinate.

1961 - No. 7

3.23 Nowacki, W.: "The Three-Dimensional Dynamic Problem of Thermoelasticity" (in English), p. 419-426.

3.24 Nowacki, W.: "The Plane Non-Coupled Dynamic Problems of Thermoelasticity" (in English), p. 427-433. Solution for the stress in an infinite space subjected to an instantaneous linear heat source distributed uniformly along the axis and an infinite layer with boundary surfaces heated harmonically and free from stress.

4. Rozprawy Inzynierskie

1956 - No. 1

4.1 Thrun, Z.: "Thermal Stresses and Strains in Plate Resting on Elastic Foundations", p. 71-86. Application of the method of finite differences to the determination of thermal stresses and strains in plates.

4.2 Thrun, Z.: "Plates Subjected to the Action of Temperature with Horizontal Reaction of the Elastic Foundation", p. 87-97. Derivation of differential equations for deflection, bending and twisting moments, and shear and normal forces, for a plate on an elastic foundation.

1956 - No. 4

4.3 Nowacki, W.: "A Steady-State Three-Dimensional Thermoelastic Problem", p. 487-497. Determines the state of stress in an elastic semispace subjected to a temperature on its boundary.

4.4 Thrun, Z.: "Thermal Deformations and Stresses in Thin Rectangular and Circular Plates of Variable Thickness", p. 523-541. Developes the differential equation for a plate of variable thickness subjected to temperature difference between the upper and lower face. Steady temperature fields are considered.

1957 - No. 3

4.5 Madejski, J.: "Theory of Similarity of Thermo-Elastoplastic Phenomena" p. 481-492.

4.6 Nowacki, W.: "A Quasi-Steady-State Three-Dimensional Thermoelastic Problem", p. 499-509. Solves the problem of an elastic semi-space on the surface of which a source of heat moves with a constant velocity.

4.7 Nowacki, W.: "The State of Stress in an Elastic Space Due to a Source of Heat Varying with Time in a Harmonic Manner", p. 511-521.

1958 - No. 2

4.8 Derski, W.: "Determination of the State of Stress in a Thin Circular Plate Due to Nonsteady Temperature Field", p. 253-263.

1958 - No. 4

4.9 Piechocki, W.: "The State of Stress in a Circular Disk Due to the Action of a Source of Heat", p. 649-656.

1959 - No. 1

4.10 Nowacki, W.: "Steady-State Thermal Stresses in Plates", p. 3-24. Method for determining stresses in a plate of moderate thickness in a continuous or discontinuous temperature field, using Green's function of the differential equation of the problem. Bending moments and torques are

III.B.4 Rozprawy Inzynierskie (Cont'd.)

4.10 (Cont'd) determined for simple cases such as those of the infinite plate, plate strip and plate wedge. Thermal stresses in plates on an elastic foundation are discussed.

1959 - No. 2

4.11 Derski, W.: "The Stresses and Displacements in a Thick Circular Plate Due to an Unsteady Temperature Field", p. 191-235.

1960 - No. 1

4.12 Piechocki, W.: "Thermoelastic Analysis of a Circular Disk", p. 93-100.

1960 - No. 4

4.13 Sokolowski, M.: "Thermal Stresses in Spherical and Cylindrical Shells", p. 641-667

1961 - No. 1

4.14 Derski, W.: "The State of Stress and Displacement in a Thick Circular Plate, Due to the Action of a Non-Steady-State Temperature Field", p. 21-40. Analysis of the state of stress and the displacements in a thick circular plate subjected to an unsteady temperature field. Asymptotic formulas are given which describe with sufficient accuracy the process of stress variation in the outer layers during the first seconds of the heating process.

5. Miscellaneous

1954

Inzynierskie Budowy No. 4

5.1 Kacner, A. and Lewicki, B.: "Nonuniformly Heated Beams on Elastic Foundations", p. 122-128.

1958

Prezeglad Mechaniczny No. 4

5.2 Klebowski, Z. and Wilcynski, A.: "Calculation of an Axisymmetric Plate with a Load Resulting from Its Deformation", p. 140-142.

C. RUSSIAN LANGUAGE

(All references cited are in Russian unless otherwise stated.

1. Academy of Sciences of the USSR

Proceedings of the Academy

1955

Dopovidi Akad. Nauk URSR no. 3 pp. 231-234

III.C.1 Academy of Sciences of the USSR (Cont'd)

1.1 Panasyuk, V.V., Podstrigach, Ya, S., and Yarcma, S.Y., "Heat stresses in a cylindrical shell" (in Ukrainian). An analysis of the stresses in a cylindrical shell with unconstrained ends, under the effect of a temperature constant along the length and thickness of the envelope but variable along the periphery of the cross section. Experimental data confirming the analysis are included.

1958 - May - June
Dokladi Akad. Nauk SSSR (N.S.) 120, 2, p. 265-268

1.2 Rozovskii, M.I.: "Stresses in a Symmetrically Heated Spherical Shell Whose Mechanical Properties Depend on Time and Temperature" (Translation in Soviet Phys. - Doklady, Vol. 3, Jan. 1959, pp. 667-671). A closed spherical shell of uniform thickness, free of surface tractions and residual stresses, is subjected to a temperature change which is a function of radius and time. The thermal coefficient of expansion, Lame coefficients and relaxation characteristics are also functions of the temperature. A hollow sphere subject to a steady-state temperature distribution is used as an illustration

1958
Dop. Akad, Nauk URSR no. 10, pp. 1054-1057

1.3 Shevchenko, Yu. M., "A general solution of the problem in the Theory of Elasticity when the Modulus is Variable". Differential equations for the theory of elasticity in transpositions are presented for the case of a variable modulus of elasticity of the second order when thermal deformation and spatialforces are present. The axially symmetrical problem is investigated. It is shown that the solution in this case only takes into account the change of the modulus along the generatrix; a general form for the solution is furnished. The possibility is noted of simplifying the general solution of the axially symmetrical problem when the changes in the modulus are small.

1961 - January 11
USSR, AN, Doklady, Vol. 136, p. 313-315

1.4 Kurshin, L. M.: "Stability of Wing Panels Under Heating" (Translation in Soviet Phys. -Doklady, Vol. 6, July 1961, pp. 77-79). Analysis of the stability problem in thin-walled, multi-spar wing structures subjected to unstationary aerodynamic heating. It is assumed that the structure has a large number of sections and has a sufficiently large dimension in the direction of the y-axis, perpendicular to the x_1- and the x_2- axes.

III.C.1 Academy of Sciences of the USSR (Cont'd)

Bulletin, Technical Sciences Section
(Izv. Akad. Nauk SSSR, Otd. Tekh. Nauk)

1957 - No. 7, July

1.5 Rozenblyum, V. I., "On Shakedown of Nonuniformly Heated Elastoplastic Bodies". Investigation of the problem of thermal stress in nonuniformly heated elasto-plastic bodies in terms of their adaptability.

1957 - October, No. 10

1.6 Rozenblyum, V. I., "On the Analysis of Thermal Stresses in a Turbine Rotor at Starting", p. 80-83. Closed form solution to the transient axisymmetric problem of a long thick walled cylinder with the temperature of the surrounding medium varying linearly along the axis.

1958 - August, No. 8

1.7 Aksel'rad, E. L., "On the Thermal Deformations of Hetero-geneous Shells" p. 48-52. Solution for a shell of arbitrarily varying elastic properties and temperature expansion coefficient for that load distribution which would cause the same deformations as a given temperature distribution.

1958 - October, No. 10

1.8 Kovalenko, A. D., "Some Problems of Thermoelasticity in Connection with Thermal Stresses in Turbine Rotors", p. 68-76. Solution for the thermal deformation of a thin circular disk of symmetric profile subjected to a sinusoidally symmetric temperature field.

1958 - December, No. 12

1.9 Il'yushin, A. A., and Ogibalov, P. M., "On Plastic Deformations of a Thick Walled Tube under the Action of Heat Impulses and Pressure", p. 85-89.

Bulletin, Technical Sciences Section, Mechanics and Machine Construction
(Izv. Akad. Nauk SSSR, Otd. Tehn. Nauk, Meh. Masinostro)

1959 - No. 5

1.10 Seoterikov, S. A.: "Temperature Stresses in an Elastic Disc" p. 177-179.

Collection of Works of the Institute of Building Mechanics
(Sb. Tr. In-ta Stroit. Mekhan. Akad. Nauk USSR)

1956 - No. 21

1.11 Amiro, I. Ya., "Determination of Temperature Stresses for a Two - Dimensional Problem of the Theory of Elasticity" p. 44-50. Finite difference solution of the two-dimensional theory of elasticity equation

III.C.1 Academy of Sciences of the USSR (Cont'd)

1.11 (Cont'd) applied to the thermal stress problem of a concrete dam structure and comparisons with one-dimensional solutions.

Scientific Notes of the Institute of Mechanical Engineering and Automation (Nauchn. Zap. In-ta Mashinoved. i Avtomatiki, Akad. Nauk USSR)

1957 - Vol. 6

1.12 Yarema, S. Ya., "Analysis of the Thermal Stresses in the Cylindrical Part of a Boiler Shell" p. 60-74.

Institute of Mechanics, Engineering Collection (USSR, AN, Institut Mekhaniki, Inzhenernyi Sbornik)

1959 - Vol. 29

1.13 Lomakin, V. A., "One-Dimensional Problem of Temperature Stresses in a Elastoplastic Medium." (Translation in ARS Journal, Russian Supplement, Vol. 30, Nov. 1960, pp. 1034-1036). Presentation of the solution to the one-dimensional problem of temperature stresses in an elastoplastic medium under condition of realistic heat exchange.

Bulletin, Technical Sciences Section, Mechanics and Machine Construction. (Izv. Akad. Nauk SSSR, Otd. Tekh. Nauk, Mekh. i Mash.)

1960 - Nov. - Dec. - No. 6 pp. 57 - 62

1.14 Shorr, B. F.: "Analysis of Non-Uniformly Heated Cylinders in the Elastoplastic Range".

2. Journal of Applied Mathematics and Mechanics (Prikladnaia Matematika i Mekhanika)

1955 - Vol. 19

2.1 Lomakin, V. A., "Elastic-Plastic Equilibrium of a Sphere in a Non-steady Temperature Field" pp. 244-248. An examination is made of the elastic-plastic equilibrium of a sphere (in the presence of strengthening) on the basis of the theory of small elastic-plastic deformations. A detailed analysis is made of the problem of stresses in a cooled sphere on the condition that the temperature of the surface of the sphere at the initial instant is reduced to zero and, further, remains equal to zero. The residual stresses are calculated.

1958 - Vol. 22 (Jan. - Feb.)

2.2 Shapovalov, L. A., "The Influence of Nonuniform Heating on the Stability of a Compressed Bar, pp. 119-123. (Reprint order no. PPM. 10, Pergamon Press, 122 E. 55th St., New York 22, N. Y.) Considers the stability of a clamped, compressed bar of rectangular cross section undergoing

III.C.2 Journal of Applied Mathematics and Mcehanics (Cont'd)

2.2 (Cont'd) small, elastie-plastic deformations under eonditions of nonuniform heating. The stress-strain characteristics of the material are arbitrary and the temperature field is assumed constant along the length of the bar and varying linearly aeross the eross seetion in the direetion of lateral bending. For the assumed boundary conditions, the nonuniform heating does not eause initial bending of the bar, For the case of an ideally plastie material and also for a material with a linear strain hardening, results ean be obtained in a closed form.

1959 - Vol. 23 (May - June)

2.3 Nowacki, Witold, "Some Three-Dimensional Problems of Thermoelastieity" pp. 456-467 (Translation PMM-J. Applied Math. and Meeh. No. 3, 1959 pp. 651-665). Study of thermal stresses due to the effeet of nonstationary heat sourecs arbitrarily distributed in elastie and viseoelastie media. The derivation of Green's funetions for stresses produeed by instantaneous eoneentrated heat sourees is analyzed, and the state of stress in perfeetly elastie and viseoelastie bodies is studied.

1960 - Vol. 24 (Mar. - Apr.)

2.4 Bolotin, V. V., "Equations for the Nonstationary Temperature Fields in Thin Shells in the Presence of Sourees of Heat" p. 361-363. (Translation PMM-J. Appl. Math. & Mech., vol. 24, no. 2, 1960, p. 515-519.) Presentation of the equations for the thermoelastieity of thin shells.

1960 - Vol. 24 (July-August)

2.5 Balabukh, L. I., and Shapovalov, L. A., "O Variatsionnykh Uravneniiakh Termouprugosti" p. 703-707. Derivation of the variational equation for the thermoelastic problem with heat sources and sinks. The eonditions under whieh the generalized Biot equation is transformed into the variational equation for the thermodynamics of equilibrium proeesses are indicated.

3. Crystallography (Kristallografiza)

1956 - Vol. 1

3.1 Greehushnikov, B. N., and Brodovskii, D., "Thermal Stresses in Cubic Crystals" pp. 597-599. A study of the plane deformation of an unevenly heated elastie anisotropie body, possessing at least one plane of elastie symmetry. The general equations of plane deformation are derived on the assumption that spatial forees are nonexistent, while temperature T appears as a linear funetion of time and depends on eoordinates x, y.

3.2 Sirotin, Yu. I., "Temperature Stresses Arising on the Heating and Cooling of Monoerystals" pp. 708-717. Thermoclastie stresses are determined in an isotropic elliptical eylinder, in an anisotropie plate, and in a spherical monoerystal of cubieal syngony.

III.C.4 Miscellaneous

1952 and 1954

4.1 Izv. Vses. n. - i. in-ta gidrotekh. Vol. 47 pp. 72-102, 1952; Vol. 51, pp. 23-54, 1954. Guttman, S. G., "The Determination of the Heat Stresses in Harmonic Temperature Fluctuations". The temperature at the surfaee of the body is assumed to be determined as a sinusoidal time function, The temperature distribution and elastie stresses, neglecting the inertia forees, are determined. The cases of a slab, hollow sphere, cylindrical pipe, and cylindrical cavity are examined.

1954

4.2 Vestnik Mach. no. 9, p. 70-75 (Bulletin of Machine Building) Kuz'minov, S. A., "Calculation Method for the Determination of General Deformation of Structural Parts due to Welding".

4.3 Sb. statei po sudostroeniyu, Leningrad, Sudpromgiz (Collection of Articles on Shipbuilding) p. 84-91. Shimanskii, Yu. A., "Calculations of the Stresses and Deformation of the Hull of a Ship due to Temperature". An approximate calculation of the stresses and deformations of the hull of the ship, resulting from differences in temperature of its longitudinal joints. A number of special cases of the distribution of temperature are investigated, and formulas are deduced for the deflection and the angle of inclination of the neutral axis. Detailed numerical examples of the calculation are furnished.

1955

4.4 Zavod. Lab. Vol. 21, No. 6, p. 722-724 (Factory Laboratory) Gelman, A. S., and Popov, V. S., "Method of Determining the Residual Stresses in Butt Joints of Steel Pipes Having Various Coefficents of Heat Expansion". An examination of a joint by contact welding of two pipes with different coefficients of heat expansion having at the instant of welding the same diameter and the same wall thickness.

1956

4.5 Izv. Kievsk. Politekhn. In-ta, Vol. 19, p. 455-461 (Bulletin of the Kiev Polytechnieal Institute). Kvitka, A. L., Agarev, V. A., and Umanskyi, E.S., "The Solution of the Axially-Symmetrical Problem of the Theory of Elasticity by Electrical Analogy for the Case of the Presence of Centrifugal Forces and Temperature Fields".

1957

4.6 Uch. Zap. LGU no. 217, p. 272-287 (Scientific Reports of the Leningrad State University). Talypov, G. B., "Deformation and Stresses at Points in a Sheet, due to Rectification by Heat Treatment". Solution of the centrally heated infinite sheet.

III.C.4 Miscellaneous (Cont'd)

4.7 Izv. Tomskogo Politekhn. In-ta, Vol. 85, p. 333-342 (Bulletin of the Tomsk Polytechnical Institute). Pinskii, M. G., "Bending of a Plate Resting on Elastic Double-I Beams During Heating". The bending is investigated of an evenly loaded rectangular plate, two opposite edges of which are fully supported, while two others are supported on elastic double-I beams. The distance, e, from the axis of the beam of the central surface of the plate may vary from a zero value to a value of e_{max}; in the latter case the plate would be found lying on the top of the double-I beams.

1957

4.8 Trudi Lenigrad In-ta Aviats. Priborostroenie (Instrument Manufacturing), no. 24, p. 41-96. Aksel'rad, E. L., "Calculation for Shells, Heterogeneous in their Thermoelastic Properties, and its Application to Bimetallic Elements in Apparatus". Solutions are given for bimetallic elements in the form of a strip and for a shell of rotation, taking into account the thermal stresses. The first part of the paper deals with the general problem on the deformation of a shell with variable elastic constants with consideration for the temperature and the problem on the deformation of a homogeneous uniformly heated shell which is under the action of a certain load. The second part is devoted to solutions of concrete problems on the determination of stresses and deformations in bimetallic shells and plates. Experimental data are furnished with confirm the calculations.

4.9 Vestn. Mosk. In-ta, Ser. Mat., Mekh., Astron., Fiz., Kbimii no. 3, p. 39-49 (Bulletin of the Moscow University - Series on Mathematics, Mechanics, Astronomy, Physics, and Chemistry). Katasonov, A. M., "The Propagation of Spherical, Thermoductile, Elastic Perturbations".

1958

4.10 Sb. Nauchn. Tr. Leningr. Inzh. - Stroit. In-ta no. 29, p. 4-11. (Collection of Scientific Transactions of the Leningrad Engineering and Building Institute). Aga, M. S., "The Convergence of the Series in the Solution of the Problem on the Thermal Elasticity of a Plane Arc Section". The plane problem in the theory of elasticity is investigated for a region bounded by two radii r_1 and r_2 and the arcs of these radii forming a central angle $2\ \psi_0$. It is assumed that on the rectilinear part of the contour the region is thermally insulated while through the curvilinear parts of the contour there is radiation of heat into the surrounding medium.

4.11 Zavod. Lab., USSR, Vol. 24, March, p. 329-331 (Factory Laboratory). Markovets, M. P., and Tret'iakov, V. P., "Method of Determination of Resistance to Warping at High Temperatures". (Translation in Indust. Lab. Vo. 24, May 1959, pp. 368-369 by Instrument Society of America, Pittsburgh, Pa.).

III.C.4 Miscellaneous (Cont'd)

4.12 Izv. Akad. Nauk Armyan SSR, Fiz. - Mat. Nauk Vol. 11, No. 1, p. 27-46 (Bulletin of the Academy of Sciences of the Armenian SSR, Series on Physicomathematical Sciences). Zadoyan, M. A., "Temperature Stresses in Infinite Concrete Slabs with Account Taken of Creep". Transient thermal stress in infinite concrete slabs with account taken of creep has been investigated on the basis of Arutyunyan's theory of creep. The instantaneous modulus of deformation is assumed to be time dependent. The integral equations of creep are reduced to differential equations with initial conditions.

4.13 (Bulletin of the Academy of Sciences of the Armenian SSR, Series on Physicomathematical Sciences) Vol. 11, No. 2, p. 101-109. Manukyan, M. M., "Thermal Stresses due to Exothermy of Cement in Blocks in the Shape of Slabs When Taking into Account the Creep of Concrete". In a former study a graphoanalytical method is proposed for the determination of thermal stresses produced in concrete slabs because of exothermy of the cement. These results are used and also the results in the theory of creep worked out by N. Zh. Arutyunyan to investigate the problems of stresses with consideration for the creep of concrete. Recurrent formulas are obtained for the stresses, on the basis of which graphs are drawn characterizing the changes of stress in the course of time.

1959

4.14 Izv. Vyssh. Uchebn. Zavedenii: Lesn. Zh. no. 1, p. 112-125 (Bulletin of the Institutions of Higher Education: Forestry Journal). Gurkin, G. S., "Loss of Strength in the Plane Form of Equilibrium of a Circular Saw Disk During the Action of Thermal Stresses". Solution is based on the following assumptions: (1) the plate is elastic and thin, (2) the inner edge of the plate is rigidly clamped while the outer edge is free, (3) the distribution of the temperature and the temperature stresses is axially symmetrical.

4.15 Collection of Works, Leningrad Institute of the Rail Transport Engineers No. 164, pp. 84 - 153 (Sb. Leningr. In-ta, Inzh. Zh-d., Transp.) Stepkin, S. A.: "Calculations of Arches with Superstructures by the Use of the Matrix Method". Arches are investigated with hinged and also with rigidly fastened bracing of the superstructure. Determinations are made of the thermal forces and displacements during uniform heating of the arch.

4.16 Uchen. Zap. Belorussk. In-ta Nar. Khva. Cobolevskii, V. M., "Elastic and Elasto-Plastic Loading Condition of a Hemisphere in an Elastic Medium under the Influence of Internal Pressure and Radial Stationary Flow of Heat." Solution of a problem regarding the elastic and elasto-plastic condition of a hollow in an elastic medium under the influence of internal pressure and radial stationary and non-stationary heat flow.

III.C.4 Miscellaneous (Cont'd)

1960

4.17 Izv. Vyssh. Uchebn. Zaved.: Aviats. Tekhn. no. 1, p. 134-143. (Bulletin of the Institutions of Higher Education: Aviation Engineering). Fridman, L. I., "Temperature Stresses at Elliptical Orifices". Solution of the plane problem in the theory of elasticity with assigned forces on the contour of the elliptical orifice. The curves furnished show the relation of the semi-axes of the ellipse to the concentration of stresses in the plate which will give the smallest value with different principles governing the temperature in the plate.

Academy of Sciences of the Ukrainian SSR
(Kiev, Akad. Nauk. URSR)

4.18 Kavalenko, A.D.: "Complex Flexure of a Round Plate of Variable Thickness in an Axially Symmetrical Temperature Field". pp. 5-27.

4.19 Kornienko, V. T.: "An Investigation of the Thermal Stresses in a Round Plate of Variable Thickness with the Aid of the Differential Analyzer "Integral I". pp. 164-176.

4.20 Aviatsionnaia Tekhnika, No. 3, pp. 124-134. Manokhin, D. G., "Priblizhennoe Opredelenie Temperaturnykh Napriazhenii V Tonkostennykh Konstruktsiiakh." Approximate determination of thermal stresses in thin-walled structures of homogeneous material. The case of a beam of constant cross section is considered, assuming that the axial forces act upon the longitudinal ribs and the attached strips of skin, and that the skin is subjected to shear. The effect of bending moment is taken into account and the method of calculation for normal as well as tangential stresses is indicated.

1961

4.21 Zh. Prikl. Mekh. Tekh. Fiz. no. 2, Mar./April, p. 111-115, (Journal of Applied Mechanics and Technical Physics) Kostyuk, A. G., "Development of Elasto-Plastic Deformations in Plates Subject to Nonstationary Thermal Effects". Presents an analytical solution of the problem of the elastic-plastic deformation of a plate subject to a unilateral and a bilateral thermal shock. The derivation of the fundamental equations of the problem is given in terms of the deformation theory.

4.22 Inzhener. - Fiz. Zh., vol. 4, April, p. 32-37 (Engineering-Physics Journal). Rozenblium, V. I., "The Calculation of Temperature Stresses in a Cooled Vane of a Gas Turbine." Bending moments and shear forces appearing in a hollow vane cooled by a liquid flow are investigated. The simplified theory of thin shells is used and the case of linear thermoelasticity is considered.

III.C.4 Miseellaneous (Cont'd)

4.23 Inzhener - Fiz. - Zh. 4, 4, 75-79, April (Engineering Physies Journal). Shevelev, A. A., "Temperature Stresses and Optimal Heating Conditions." Diseussion of the problem of eooling of an infinite plate, infinite eylinder and a solid sphere from the viewpoint of temperature stresses. Solution is in series form employing eriteria of similarity (Biot's), irregularity of thermal field and cooling velocity.

4.24 Engineering - Physics Journal, Vol. 4, August, pp. 99 - 106 (Inzhener. - Fiz. Zh.) Makhovikow, V. I.: "The Solution of Problems of Heat Transfer and Thermal Elasticity for a Cylinder of a Multiply Connected Cross-Seetion".

4.25 Kalugin, B. A., and Mikhailov, I. G., Soviet Physics - Acoustics (Akusticheskii Zhurnal). Translation by American Institute of Physics, New York, Vol. 7, No. 2 Oct-Dec 1961, p. 154-158. "New Ultrasonic Method for Measuring the Elastic Properties of Solids at High Temperature", Anultrasonic pulse method for measuring the elastic constants of materials (Youngs modulus, shear modulus, Poisson ratio) , at high temperatures is described.

1962

4.26 Inzhenerno - Fizicheskii Zhurnal, Vol. 5, January, p. 102-107 (Engineering-Physics Journal) Shulman, S. G.: "O Vliianii Polzuchesti Na Napriazhennoe Sostoianie Sostavnogo Treugol'nogo Profilia". Study of the effect of creep upon the stress distribution in a radially divided, triangular sectional profile. The elastic and rheological characteristics within each layer are constant. Formulas for determining the stresses in each layer, at any time, are derived.

4.27 Aviatsionnaia Tekhnika, No. 3, pp. 111-121, Uzdalee, A. I., "Unsteady Temperature Stresses in an Anisotropic Cylinder." Study of the title problem for a finite cylinder with circular cross-section.

D. OTHER LANGUAGES AND COUNTRIES

1. French Language

Bull. Tech. Suisse Rom.

1954 - April

1.1 Strub, R. A.: "Generalized Method for the Calculation of Mechanical and Thermal Stresses in Disks of Arbitrary Profiles"(in French), p. 97-106. The differential equation of radial displacement in rotating conical disks subject to centrifugal and thermal stresses is integrated graphically by a method suggested by Meissner.

III.D.1 French Language (Cont'd)

Rech Aero.
1957 - Nov/Dec.

1.2 Bonneau, E.: "Influenee of Kinetic Heating on the Vibratory Response of the Torsional Mode of a Wing" (in French), p. 27-34. Deals with thermally-stress indueed loss in wing torsional stiffness. Considers solid wings of rectangular and double-wedge cross section. Results are compared with existing information.

Rev. Univ, Mines
1959 - July

1.3 Salier, N.: "The Role of the Tube Thickness and Thermal Stresses in Superheaters of Ferritic and Austenitic Steel"(in French), p. 633-649. A study of the combined effect of pressure and thermal stresses in ferritic and austenitic steel heaters. The analysis employes the fundamental coneepts of elasticity theory and plasticity theory, together with thermal hysteresis phenomena for the teehnical and economical comparison.

2. Italy (Italian and English References)

(The following references are in Italian unless otherwise noted.)

Aerotecnica
1956 - Oct.

2.1 Giovannozzi, R.: "Tavole Per Il Calcolo Di Dischi Conici A Spessore Sia Decrescente, Sia Crescente Verso L'Esterno, Con Peso Specifico E Temperatura Variabili Lungo Il Raggio", p. 333-355. Tables for the calculation of conical discs whose thicknesses decrease or increase with their radii and whose specific weight and temperature vary along the radius. These tables are based on an exact analytical solution of the hypergeometric equation occurring in the determination of centrifugal and thermal stresses in the conical disc (the thickness of which varies linearly with its radius) for the case of increasing thickness. Includes a numerical example of a gas-turbine disc to illustrate the use of the tables.

1957 - August

2.2 Santini, P.: "Thermoelastodynamics of Shell Wings", p. 201-208. Thermal stress solution of a wing, consisting of a rectangular shell supported by spanwise spars, subject to a temperature distribution on its surface varying chordwise and with time. The only stress resultants are the normal stress in the spars and the shearing stress in the spanwise direction in the shell.

1959 - April

2.3 Broglio, L.: "Some Contributions to the Heat Conduction and Thermal Stress Analysis in Aircraft and Missile Structures", p. 53-65.

III.D.2 Italy (Cont'd)

Atti Accad. Sci. Torino
1957/1958 - No. 1

2.4 Choudhury, P.: "Three-Dimensional Thermal Stresses Due to Periodic Supply of Heat on the Plane Boundary of a Semi-Infinite Solid" (in English) p. 3-9. A solution of the title problem in the form of Fourier integrals is proposed. The discussion is based on classical Neumann-Duhamel stress-strain-temperature relations.

G. Gen. Civ.
1960 - May, 98, 5

2.5 Adriani, L., "Thermal Stresses in Stiffened Arch Bridges." (In Italian) pp. 365-372.

Missili
1961 - December

2.6 Santini, P.: "Influenza Della Variabilita Dei Coefficienti Elastici Nei Regimi Di Sforzi Termici", p. 25-32. Analysis of thermal stresses in spherical and cylindrical shells having moduli of elasticity and Poisson's ratios which vary throughout the shells. A modified equation is derived for the elementary case, and general expressions are derived for the thermal stresses. Composite structures are studied, and approximate methods for the solution of the stress equations are described. The case of a thick cylinder is considered.

Tecnica Italiana
1961 - March

2.7 Levanti, G.: "Due Casi Di Distribuzione Piana Delle Tensioni Termiche Trattati Col Metodo Di Variabile Complessa", p. 129-134. Analysis, by means of the complex-variable method, of the thermal stresses in a long cylindrical duct under steady-state temperature conditions, for the two cases: (1) a heated fluid flows through the duct maintaining the internal surface at a given temperature while the outer surface radiates heat into the ambient medium; (2) an electric current passes through a conductor along the axis of the duct, supplying heat at a rate which is constant per unit length, while the external surface is maintained constant at 0°C.

3. Japan (Japanese and English References)

(The following references are in Japanese unless otherwise noted.)

Jl. of the Japan Soc. of Aero. Eng.
1955 - Sept.

3.1 Mura, T.: "Extremum Principles of the Thermal Elasto-Plastic Stresses," p. 215-220. Conceptual development of principles to determine practical design criteria for the analysis of temperature-dependent structural problems.

III.D.3 Japan (Cont'd)

1957 - Jan.

3.2 Mura, T. and Kinoshita, N.: "Expression of Initial Stresses Based on Green's Functions", p. 7-10. Analysis to determine at what point the induced thermal stress source becomes maximum and the magnitude of the maximum value. When the internal stress source is given, the initial stress is expressed, using Green's functions, by the incompatibility and the dislocation of the internal stress source.

1957 - Feb.

3.3 Hayashi, T.: "On the Effect of Flight Loads and Thermal Stresses on the Deformations of Wing Sections and Skins of High Speed Airplanes. I-Fundamental Equations for the Thermo-Elastic Problems of a Plate and Its Thermo-Elastic Buckling", p. 1-7. Derivation of fundamental equations for a plate subjected to a nonuniform temperature distribution over its surface and to external forces in its middle surface. The stress state and the deformation of a rectangular plate under a nonuniform temperature are analyzed and the conditions of thermo-elastic buckling are derived as a special case.

Jl. of the Japan Soc. for Aero. and Space Sci.
1961 - Feb.

3.4 Sunakawa, M.: "Thermal Deformation of a Clamped Rectangular Plate Subjected to Kinetic Heating", p. 1-6 (summary in English). Analysis of the thermal deformation of a clamped edge plate subjected to an arbitrary symmetrical temperature distribution. The fundamental nonlinear partial differential equations for the problem are derived and solved, taking finite deformation into account.

Aeronautical Research Institute, Tokyo
Report No. 352 Mar. 1960

3.5 Vemura, M.: "Deformation and Thermal Stress of Rectangular Beams of Flat Strips Heated at One Surface". Analysis, considering the effect of finite deformation, for the two cases of clamped and simply supported ends, with axial displacement restrained.

Report No. 353 May. 1960

3.6 Miura, K.: "Thermal Buckling of Rectangular Plates". Thermal buckling of the plate simply supported by the web is analysed when the system is subjected to an arbitrary symmetrical temperature distribution over the plate surface. The buckling criterion is established and a simple approximation for buckling criterion is obtained.

III.D.3 Japan (Cont'd)

Report No. 354 May 1960

3.7 Miura, K.: "On Torsional Rigidity and Torsional Vibration of Aerodynamically Heated Wings having a Small Amount of Pretwist". Approximate analysis of the torsional rigidity and torsional vibration of aerodynamically heated wings having small amounts of pretwist. The combined effects of pretwist and thermal stress on the torsional rigidity are discussed and shown to be considerable.

Report No. 359 Dec. 1960 (Vol. 26, No. 10, p. 195-213)

3.8 Sunakawa, M. and Vemura, M.: "Deformation and Thermal Stress in a Rectangular Plate Subjected to Aerodynamic Heating (For the Case of Simply Supported Edges)". Analysis of the deformation and the thermal stress of a simply supported rectangular plate subjected to an arbitrary symmetrical temperature distribution. Finite deformation is taken into account.

Meiji Univ. (Tokyo)
Research Report No. 10 1957

3.9 Mura, T.: "Residual Stresses Due to Thermal Treatments".

Tohoku Univ.
Technological Report Vol. 25, No. 2, p. 249-262 (1961)

3.10 Shimada, H.: "Photoelastic Investigations of the Thermal Stresses in Composite Models".

Jl. of the Japan Soc. for Aero. and Space Sci.

1962 - March

3.11 Uemura, M. and Sunakawa, M.: "A Rapid Radiant Heating Appartus and an Experiment on the Thermal Deformation of Clamped Square Plate." (In Japanese, with summary in English) p. 5-11. Description of test heating equipment with a capacity of 20 kw. and its application to an experiment on the thermal deformation of a plate. The results show that the experimental relation between the temperature and deflection of the midpoint of the plate agrees satisfactorily with a previously derived theoretical result.

1962 - April

3.12 Sunakawa, M.: "Deformation and Buckling of Cylindrical Shells Subjected to Heating". (In Japanese, with summary in English.) p. 1-13. Derives simultaneous nonlinear partial differential equations for the thermoelastic problems of a cylinder, considering the normal pressure as well as the effect of the temperature gradient through the thickness. Solutions are presented for three different cases: (1) a cylindrical shell that is free from constraints upon thermal expansion and axial displacement, but

III.D.3 Japan (Cont'd)

3.12 (Cont'd) restrained laterally against pressure at the edges; (2) a cylindrical shell unrestrained longitudinally, but fully restrained laterally at the edges; and (3) a cylindrical shell clamped completely at the edges.

4.. Israel

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Report No. 4 June 1959

4.1 Singer. J.: "Simplified Equations for Thin Circular Conical Shells under Arbitrary Loads and Arbitrary Temperature Distributions". Derivation of simplified differential equations governing the deformation of circular conical shells using the principle of the minimum total potential energy. The equations reduce to Donnell's equations (extended to include an arbitrary temperature distribution) when the cone angle approaches zero. For convenience, the equations are also given for particular types of temperature distributions and for zero temperature rise.

Report No. 6 Dec. 1959

4.2 Singer, J. and Hoff, N. J.: "Buckling of Conical Shells Under External Pressure and Thermal Stresses". Simplified differential equations governing the deformations of deep thin circular conical shells subjected to arbitrary loads and arbitrary temperature distributions are derived by the principle of the minimum total potential energy.

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ETH Inst. fur Flugzeugstatik and Leichtbau
Mitteil. No. 4 1958

5.1 Blisplinghoff, R. L.: "The Finite Twisting and Bending of Heated Elastic Lifting Surfaces". Description of theoretical and experimental investigations on the behavior of elastic lifting surfaces under finite twisting, finite bending, and heating conditions. The study is confined to very long elastic surfaces of rectangular plan form.

Mitteil. No. 5 1958

5.2 Houbolt, J. C.: "A Study of Several Aerothermoelastic Problems of Aircraft Structures in High Speed Flight". The thermal aspects of high speed flight with both external and internal heat flow are reviewed, and a survey of the basic equations of elasticity, modified to include temperature effects, is given. Energy and equilibrium equations applicable to platelike structures of variable thickness in the large deflection range are developed, followed by a further treatment of the technique of stress function analysis.

III.D.6 Miseellaneous

Netherlands
Applied Science Research, Section A
1955 - No. 5

6.1 Vodicka, V.: "Hollow Circular Cylinder Under Periodic Fluctuations of Temperature", p. 327-337.

1956 - No. 2/3

6.2 Van Der Linden, C. A. M.: "Thermal Stresses in a Plate Containing Two Cireular Holes of Equal Radius, the Boundaries of Whieh are Kept at Different Temperatures", p. 117-128.

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1958 - Oct.

6.3 Parkes, E. W.: "Repeated Thermal Stresses", (in Swedish), p. 955-960. Importance of plastic deformation and shakedown is discussed and illustrated with different combinations of dimensions, material properties and temperature cycles. Conditions for shakedown are indicated and results applied to limit design of a special airplane wing structure.

Roumania
Studii Si Ceretari Mecan. Apl.
1960 - No. 1

6.4 Derski, V.: "On Some Problems of Thermoelasticity", (in Roumanian), p. 131-151. Presents a solution for the unsteady thermal stresses occurring in a thick walled tube of infinite length.

India
Journal of the Aero. Society of India
1961 - Nov.

6.5 Rao, K. R. and Johns, D. J.: "Some Thermal Stress Analyses for Rectangular Plates", p. 99-104. Discussion of three methods for the determination of thermal stresses in an unrestrained rectangular plate having symmetric temperature variation across its width and temperature-independent material properties. The methods covered are (1) the principle of least work; (2) the minimum-complementary-energy theorum (Heldenfels and Roberts); and (3) sheet-stringer load diffusion (Duncan). The methods are applied to simple examples.

Austria
1960

6.6 Astronaut. Acta 6, 6
Vandenkerckhove, J. A., "Thermal Stresses and Strains in Elastic Cylindrical and Case Bonded Grains (in English), pp. 342-353. Discusses influenee of web fraction, case thiekness, relative moduli of elasticity and

III.D.6 Miscellaneous (Cont'd)

6.6 (Cont'd) grain Poisson's ratio upon significant thermoelastic results as calculated at regions removed from ends at temperature equilibrium.

E. BOOKS

German

E.1 Neubauer, R.: "Temperature and Stress Distribution in Refractories in Cylindrical Reactor Containers (Temperatur und Spannungsverteilung in ausgemauerten zylindrischen Reaktionsgefassen. Anheiz-und Abkuhlvorgange)", (In German), Springer-Verlag, Berlin, 1958

E.2 Parkus, H.: "Transient Thermal Stresses (Instationare Warmespannungen)" (In German), Springer-Verlag, Vienna, 1959. Chapter headings are: (1) Some general theorems of thermoelasticity. (2) Heating and cooling processes. (3) Periodic temperature changes. (4) Moving heat sources. (5) Dynamic effects. (6) Thermal stresses in bodies made of viscoelastic materials. (7) Thermal stresses in bodies made of elasto-plastic materials.

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E.3 Nowacki, W.: "Problems in Thermoelasticity", Panstowo Wyd-wo Naukowo, Warsaw, 1960.

IV. AUTHOR INDEX

CHAPTER V

SUBJECT INDEX

SHELLS

SOLID BODIES OF ARBITRARY GEOMETRY

Aeronautical Systems Division, Flight Dynamics Lab., Wright-Patterson AFB, Ohio
Rpt. Nr. ASD-TDR-63-783, Part I,
THERMAL STRESS DETERMINATION TECHNIQUES FOR SUPERSONIC TRANSPORT AIRCRAFT STRUCTURES. PART I - A BIBLIOGRAPHY OF THERMAL STRESS ANALYSIS REFERENCES, 1955-1962.
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